ANNUAL AUTO SECTION
50 Color Photos of the New Cars

# POPULAR SCIENCE

OCTOBER - 35c Monthly



### THE MAILMAN

REMEMBER THE MORNING I FOUND ANDY SHOLL TRYING TO TAKE ON THE WHOLE NEIGHBORHOOD...



ALL RIGHT, THEY CALLED MY
BOYS, POP A "MUSCLE
WHAT'S HEAD"JUST 'CAUSE
THE
TROUBLE? FINISHED
SCHOOL

ANDY! YOU'VE EEN FIGHTING AGAIN! OH, IF < NLY WE COULD LEAVE THIS

IEIGHBORH000

MAYBE THIS
WILL HELP...
IT'S FROM
INTERNATIONAL
CORRESPONDENCE
SCHOOLS

SURE ENOUGH, WITHIN A FEW WEEKS I BEGAN TO DELIVER MORE LETTERS AND PACKAGES FROM I.C.S.

DAYS. ANDY'S FATHER IS TAKING A CORRESPONDENCE COURSE,



IT WASN'T LONG BEFORE I BEGAN TO NOTICE CHANGES IN THE SHOLL'S HOME.LITTLE THINGS. NEW CURTAINS. FLOWER BOXES.FRESH PAINT. AND THEN, ONE MORNING...



A FEW WEEKS LATER, MRS. SHOLL MET ME AS I CAME UP THE STEPS...

HAS ANDY TOLD YOU THE NEWS?
WE'RE MOVING. MR. SHOLL IS
BEING TRANSFERRED. HE'S TO BE
A SECTION LEADER IN THE NEW
MILLDALE PLANT. HERE'S OUR



WELL, I'M REAL HAPPY FOR YOU. BUT I'M GOING TO MISS ANDY-AND THAT I.C.S. MAIL

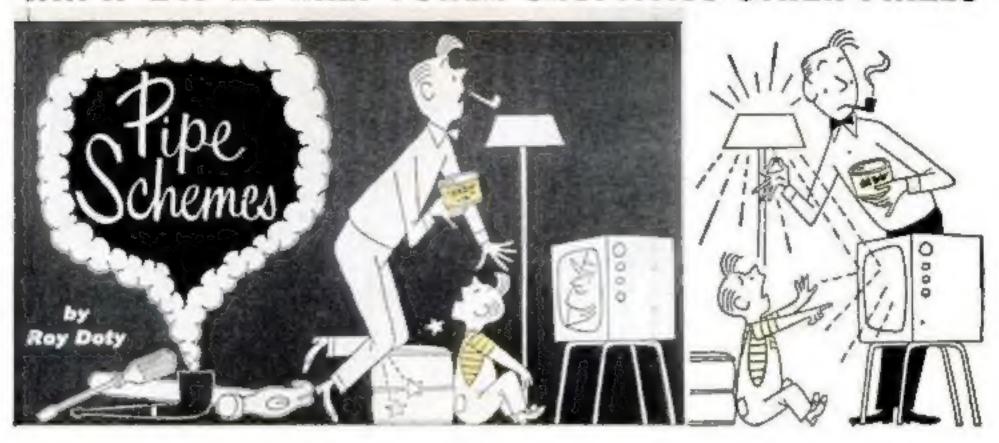
IT WAS YOU AND I.C.S. THAT MADE IT ALL POSSIBLE. WE THANK YOU BOTH!

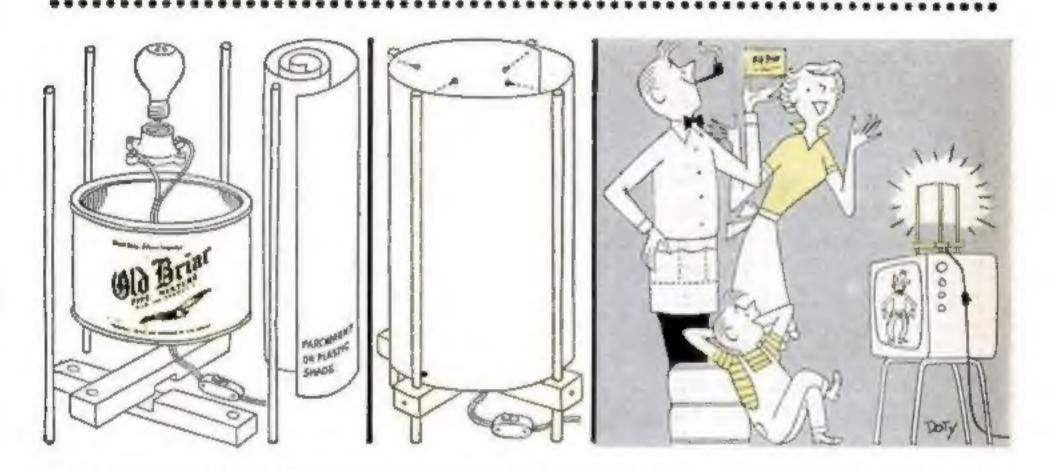
I'VE SEEN IT HAPPEN OFTEN.

I.C.S. NOT ONLY CAN CHANGE
PEOPLE'S ADDRESSES, IT CAN CHANGE
THEIR WHOLE WAY OF LIVING.



### WIN A \$249 DE WALT POWER SHOP...109 OTHER PRIZES





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100 Fourth Prizes Large can OLD BRIAR and a fine imported briar pipe.

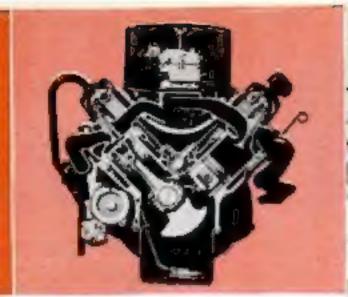


Old Briar mixturerare flavor and aroma of Latakia, burleys and domestic favorites.

EASY TO WIN! Build a TV lamp with a pipe tobacco can as shown above. Be original-the example above is just one way of building it using a tobacco can. Photograph your TV lamp, mail photo and a statement of 25 words or less on why you like Old Briar, the friendly pipe tobacco to: OLD BRIAR CONTEST, Box 3226, New York 17, N. Y. Your entry must be postmarked October 31 or sooner! Contest to be judged by Popular Science.

> (Contest subject to all Federal, State and local regulations, Employees, and immediate families of advertiser, their agency or Popular Science staff are not eligible to enter. All entries become property of U. S. Tobarco Co. for any and all purposes and cannot be returned. Winners will be notified by mail by December 31, 1960.1

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Navigators: Do they really sight on the sun? P. 98



Blackout: Birdies singing? Medics call it "aura." P. 111

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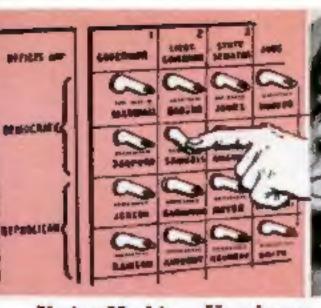
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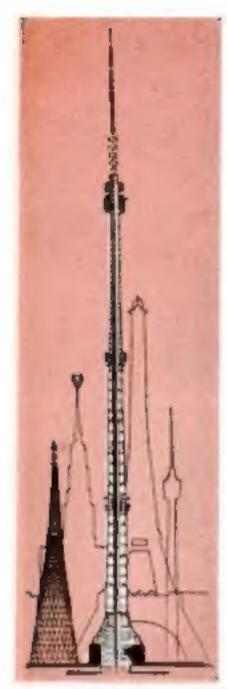
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### PS Readers

### TALK BACK



### Russians Reach High

You were right when you said that Maine's distinction as the home of the world's tallest structure [Aug.] wouldn't last long. The championship is going to Moscow, where construction has begun on a fantastic building. The Russians say that it will reach 1,666 feet, 47 feet higher than Maine's huge TV tower and 194 feet beyond the Empire State Building's height. Its antenna mast (serving three TV stations and three FM radio stations) will top a

gigantic inverted ice-cream cone of reinforced concrete. Inside the base there will be studios and offices and, at the 1,180-foot level, a three-story restaurant and observation platforms for tourists.

THEODORE M. HANNAH, Silver Spring, Md.

### Case of the Wrong Initial

My son and I were delighted to see the photographs of us ["PS Readers Talk Back," July] and the Wankel engine we built. Since then there has been considerable interest in the engine and we have demonstrated it running quite frequently.

Unfortunately, the middle initial of my name was incorrectly given, causing some confusion—there are some 50 Thomases in the city telephone directory. W. T. Thomas Sr., Daytona Beach, Fla.

### Unmarked Cars: Good or Bad?

Congratulations on "Unmarked Police Cars: Good or Bad?" [July]. At the

last session of the Minnesota Legislature, such cars were banned, as the law directs that all police cars shall be marked in the same manner and allows only the continued use of present unmarked cars, but not replacements.

I am very much opposed to our present law as I feel unmarked cars have a real value in traffic-law enforcement. I am making every effort to have the law repealed at the next session of our legislature.

> Bob B. Ebbesen, County Atty. Redwood Falls, Minn.

Police use no unmarked cars, but Portland city police do. These cars are so patently unmarked that they stand out in traffic nearly as vividly as marked cars.

Three I have in mind are '57 Fords—all of the cheapest model, with blackwall tires and a minimum of chrome trim. They're all one solid color, too, with a small aerial on top of the roof as a conspicuous finger. The city's cars, in effect,



are marked by their very plainness. They can be spotted just as easily as a police car with all the trimmings.

BARNEY R. KLIKE, Portland, Ore.

A jewelry salesman carrying samples worth \$30,000 is driving after dark and traveling a bit over the speed limit. Suddenly an unmarked car overtakes him and the driver, who can be seen only dimly, motions him off the road. The salesman takes off fast and the unrecognized policeman fires a warning shot. The salesman, sure he has met a robber, fires his gun to show he is armed. The policeman, now sure he is chasing a criminal,

CONTINUED

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### SPORTS CARS, STOCK CARS, ALL MAKES OF CARS ARE WINNING WITH AUTOLITE!

Colorado-Autolite-sparked Corvette-as well as 2 Autolite-sparked Porsches-sweep all three sports car classes in the 1960 race to the top. At Ascot Speedway, Calif.-50 lap, Late Model Stock: 9 out of 10 first finishers-including

From coast to coast, the performance of Autolite a Dodge, Mercury, Plymouth and Ford-all Spark Plugs means victory! At Pikes Peak, Autolite equipped. At O'Hare Speedway, III. -Autolite-equipped Chevrolet takes first place in 25-lap, Late Model Stock.

> The point: whatever car you drive-wherever you drive It-you're always right with Autolite!





COMMERCIAL SOD GROWER: Louis DeLea, East Northport, Long Island, N.Y. "With Super Mileage Lugs we get the traction we simply must have in the sod field, yet they're giving us real good wear out on the highway."

# FLOTATION TIRES EASE 16-TON LOADS OF SOD OUT OF SOFT FIELDS



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LUMBER PRODUCTS HAULER: Maury Goodine, Chicago, Illinois. "Running 2,000 miles a week over Route # 66 can be murder on tires. That's why we've switched to Firestones. They can really take the torture."



PRODUCE HAULER: John Romkema, Grand Rapids, Michigan. "Getting fresh produce to market on time demands a tight schedule. I can't afford any delays with tire trouble, That's why I'm 100 per cent on Firestones."



GRAVEL HAULER: Grove Lawson, Des Moines, Iowa. "I've never had a Firestone blow-out in all the years I've used them on my truck, I would recommend Firestones to anyone on the basis of the performance they've given me."



\*Firetime T.M.

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Super All Traction®

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All Truckon®

fires his gun for real. You take it from there. Was the unmarked police car worth it?

W. A. Wilson, Akron.

### Putting in Plugs the Hard Way

The gapless plugs ["The Truth About Spark Plugs," June] would be worth buying if only one of the features claimed were true: freedom from adjustments. To check and adjust the plugs on my '60 Chrysler New Yorker, the following

procedure is necessary:

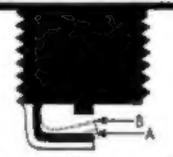
Jack up the car to two different levels (to reach front and rear plugs), use two different-length socket extensions to get at same, and—unless the manifold and exhaust pipes were given a couple of hours to cool off—don elbow-length asbestos gloves. How ridiculous is it possible to get?

H. L. HAGENBUCH, Bloomsburg, Pa.

... As you say, some plugs lose their efficiency as they become warmer. Why not solve this problem by using a bimetallic outside electrode, working like

a thermostat?

In the drawing, B would be the gap when running cold. This gap would steadily increase as temperature rises,



finally reaching a maximum distance, A, which would be the most efficient at high speeds. As speed and temperature decrease, the gap would decrease proportionately. The ratio of expansion and contraction would have to be found by trial and error.

MICHAEL KOVALIK, Steubenville, Ohio.

#### Prisoners on Ice

PARKING prisoners of war under an icecap, as one June letter suggested, may sound far fetched, but the storage of surplus food there is certainly feasible.

LEONARD STEIN, Chicago.

#### **Our Puzziers Report**

DIDN'T you goof on the puzzle about a monkey climbing a rope suspended over a pulley [June]? You say both the monkey and the weight on the opposite end of the rope would rise. Haven't you forgotten the weight of the rope? As the monkey climbs, he pulls more of the rope to his side. If he moves slowly enough, the weight could be going up and the monkey going down (in relation to the pulley) even though he was still climbing the rope.

ROBERT BATEN, Lake Charles, La.

. . . I'D SAY your answer to the climb-

ing monkey puzzle is incorrect.

Once, while working on a high scaffold and not wishing to climb down for lunch, I had the tender hook my lunch box to a pulley rope and send it up. All went fine until the weight of the rope overbalanced the weight of the box. Up it came like a shot, finally striking the pulley and almost going into orbit. There I stood, amid a cloud of sandwiches and grapes.

R. T. Hubbard, Spokane.

In Puzzledom, all simple frictionless pulley systems are weightless, a point that perhaps should have been mentioned.

... Have you run across this enigma, once popular among Latin students? Fratres et sorores nunquam habeo; sed pater illi viris est filius mei patris. Qui dicit? (Brothers and sisters I have none; but that man's father is my father's son. Who is speaking?)

Of course the "son" mentioned is the speaker and "that man" is his son or the

grandson of "my father."

J. C. Hierholzer, Umatilla, Fla.

required that we find the shortest route for a spider on the wall to get to a fly across the room. You said speed was important, so I say you should have had two answers in July: 1) 40 feet—the one you gave as shortest: 2) the fastest—the



spider drops 11 feet to the floor and then runs the last 31 feet.

DAVID J. SCHAUB, Alma, Wis.

#### So Good It Can't Die

THE bike spring that stores power ["New Ideas from the Inventors," June] is an idea old enough to be collecting Social Security.

In our files here I find an 1895 Scientific American article stating: "Device is



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so arranged that, when riding downhill, or even on the level, the rider can at will throw a spring into gear and by degrees wind it up to its limit. Then, when a hill is to be climbed, he can turn on the power and let the spring give back some of the energy stored in it."

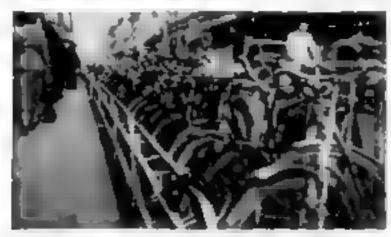
The fellow who invented it lived in a house less than a mile from his lab but 80 feet higher on the mountain. He wound up the spring on the way down to save a heavy pull on the way home. His

name was Thomas A. Edison.

WM. R. TUTHILL, Director Museum of Speed, Daytona Beach.

### **Bikes Are for Everybody**

I REALLY enjoyed "Who Says Bikes Are for Kids?" [June]. This snapshot,



taken two years ago, shows how bikes are parked in the streets in Sweden. At depots, when people take a train to the city for a shopping trip or a week's vacation, they hang their bikes on a large hook under the roof of a shed (provided by the railroad). The bikes will be there on their return. Bike locks in Sweden are most unusual.

MRS. A. H. SEABERG, Lucerne, Calif.

Wylie took my thoughts back more than 65 years to when I was a boy living on Washington Heights in New York. We all had bikes and made many trips to Coney Island via the bicycle freeway in Brooklyn to the beach. In those days there was a botel there shaped like an elephant. And cable cars clanked over the Brooklyn Bridge as we pedaled along.

### Here's the Pitch

In "Which Roofing Should You Buy?"
[June] you refer to the pitch of a roof as the same as the rise in relation to the horizontal run. I have always understood that the pitch is the ratio between the rise and the span (width of the build-

T. U. ANGELL, Santa Rosa, Calif.

ing). Therefore a roof with a rise of 4 feet in a 12-foot run (half the span) would have a 1/6 (4/24) pitch. The rise would be 4/12 or 1/3.

J. E. CROWE, Calgary, Alta.

Not so. The pitch is the slope of the sides expressed by the ratio of the height to the span. The "rise and run" is the ratio of the height to the half span.

### **Crowning Touch**

THAT long-reach fruit picker ["Short Cuts and Tips," July] doesn't look as good to me as one I have. It plucks the fruit and drops it in the sack every time—cherries as well as apples.

"t's just a crown
Lit from sheet metal
and screwed to a
long bamboo pole.
Six inches high and
six inches in diameter, it is punched
with holes at the



bottom so the cloth bag can be stitched to it. The trough of each loop at the top of the crown is similar ened slightly.

Mrs. Jack no R, Mansfield, Ohio.

### **Another Gus Wilson?**

A FRIEND of mine, who runs his own Gus-Wilson-type garage, told me an interesting story on how he's been setting the camber on certain makes and models of cars, with good results.

He just sprinkles sand on the floor and rolls the car back and forth through it. Then he studies the grains of sand adhering across the tire, and adjusts until the sand sticking to the tire is evenly spread all the way across the tread.

"I've got a gauge made for setting camber," says he, "but I don't use it except to impress customers. Even then, actually I still go by the grains of sand sticking to the tire."

R. A. Brown, Shelbyville, Tenn.

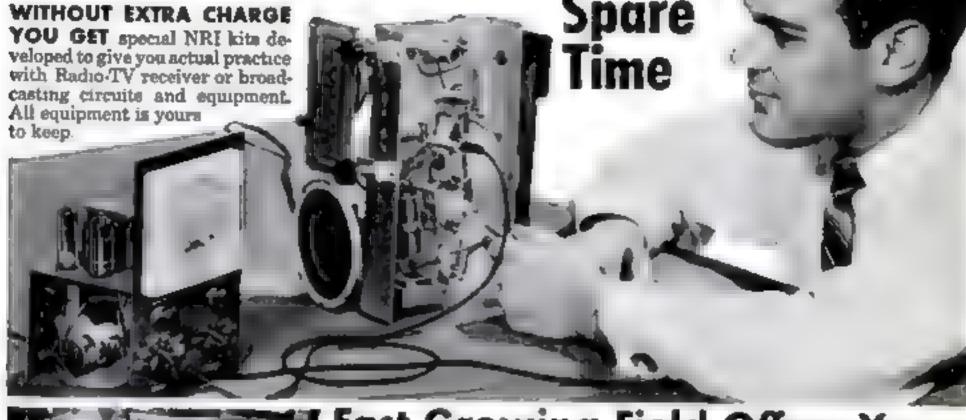
#### Aerobatics

RECENTLY, about dusk and just after a heavy rain, I noticed four or five bats flying around outdoors. Having read your article on bats last May, I remembered your question: "Can they tell size, shape . . . color?"

To experiment a little, I tossed up a small atone (the size of a pea) at a fast clip. All the bats veered up violently

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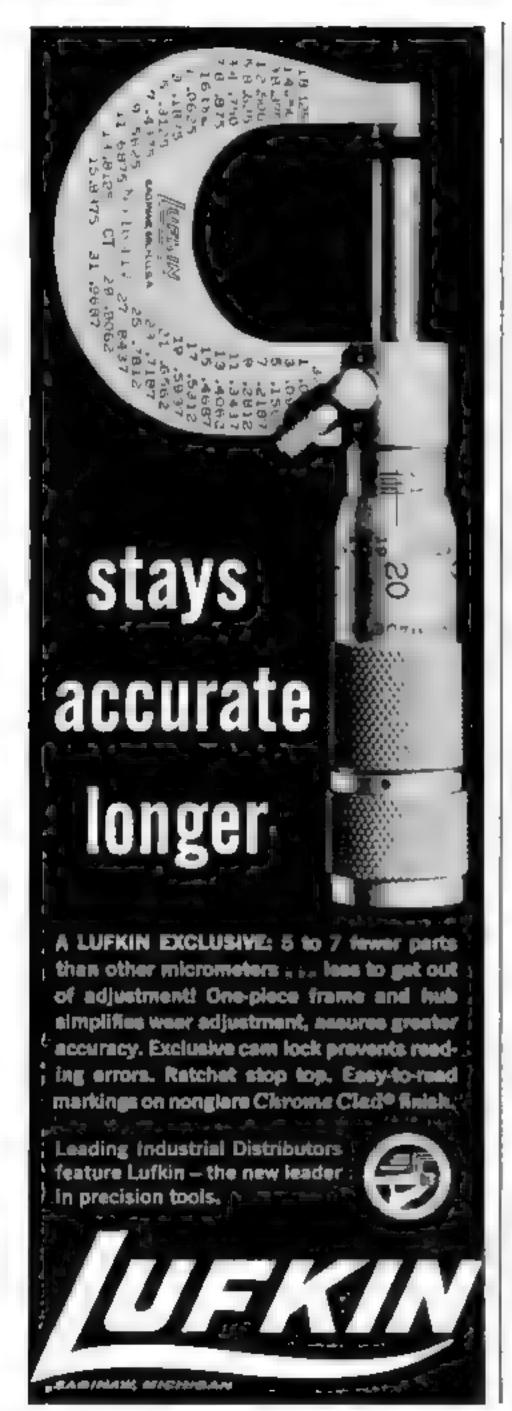
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The ABEs of



after it and went into a steep dive, barely missing the street. I tried a larger, irregularly shaped stone and they dove after it. Then I tossed up a shell ½-inch in diameter. This went off to the side, but a bat immediately dove upon it.

W. H. HANSEN, Lake Worth, Fla.

### The Machine That Walks Like a Man

In the sketches showing how a dragline walks ["Tanks That Walk and Jump," July], the circular base plate is shown being lifted clear off the ground. The one I am familiar with (Marion) just lifts up the leading edge of the base plate and drags it on its trailing edge. Don't they all?

H. E. NOLD, Winslow, Ind.

dragline is moving in the wrong direction. The way the cam is rotating in your illustration, the machine would move forward instead of backwards.

K. HILL Ja., New Philadelphia, Ohio.

The artist drew the cam action backwards. The cam should rotate clockwise.

### The Shrinking Yen

Run it in "I'd Like to See Them Make"—and you did last April—and in a few months' time it's on the market! Seems like they're now making washable



paper money in Japan—the 10,000 yen (\$25) denomination. The new paper is said to resist the effects of water 25 times better. But the money has a tendency to shrink a little after being soaked in water.

H. I. DIAZ PUMARA, Pine Grove Mills, Pa.

### A Car That Never Saw a Showroom

The car you show on page 77 in June ["Torture-Testing Cars for Police Patrol"] has a Dart front end with a regular Dodge rear end. How come?

EARL OBERMOELLER, St. Louis, Mo.

The hybrid is a special Police Model.

The inexpensive Dart front sheet metal

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SAYS A. G. NEUMEYER, President, First Western Savings



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PENNZUII POTOR OIL

Member Penn, Grade Crude Oil Assa. Permit No. 1, Oil City, Pa. is used to reduce cost of the car; the long Dodge body is used to meet specifications of highway patrols and police departments.

### Special for Dinghy Bullders

Abour that "20-Buck Dinghy for the Kids" [July]: You say, "Side edges on both pieces must be beveled—five degrees on the bow piece, 15 degrees on the transom piece." Shouldn't this be just the opposite?

CHARLES KARIAN, Webster, N. Y.

Right. The bevel should be steeper at the bow—the narrow part of the boat. The transom, which is nearly as wide as the beam, would have only a slight bevel.

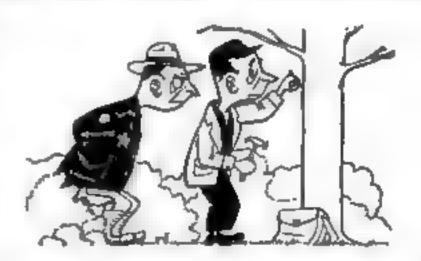
### Fastest is Still the Fastest

THE Flying Caduceus ["Jet Car Aims at 500-M.P.H. Record," July] will never make it. The use of pure jet engines, delivering power by thrust, is ruled out by the International Automobile Federation, which requires that power be transmitted to at least one pair of wheels. Thus, Dr. Nathan Ostich can never set an official land-speed record.

WILLIAM JENNINGS, Toronto, Ont.

### Woodman, Don't Nail That Tree

THE "Camping Hints from Here and There" [July] were good ones, but one thing distressed me. Two hints show items nailed to trees. Pounding nails into trees is harmful to them and against



Forest Service regulations. Anyway, isn't it easier to throw a rope around a tree limb than to climb a tree and drive in a nail?

RICHARD WHITE, Berkeley, Calif.

### Interminable Terminology

IN THE July letters, C. F. Lehman, NAS, gets a bit sticky about converters vs. inverters. We sure get arguments



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started on nomenclature, but Lehman should have done more research on the subject.

Years ago the terminology was "Inverted Converter," then "Converter" alone; now "Inverter." It depends on the person who makes the equipment or writes the text. I have a beautiful little "Inverted Converter" in my shop, 14-volt DC to 110-volt 400-cycle, of recent manufacture by a very famous company. The nameplate has engraved on it nine letters—converter.

J. H. O'CONNOR, Denver.

### Watch That Sprinkler

ONE of your Short Cuts and Tips is a short cut to trouble. The writer who suggests using a pipe tee for a gardenhose branch [June, p. 124] is going to end up with peculiar watering patterns. Did you ever try to screw a hose connector into a pipe thread?

R. O. PORTER, Grayling, Mich.

#### Cars with Fluid Controls

Discovering that fluid steering, fluid brakes, and fluid drive are soon to be joined by fluid controls ["The Month in Science," July] has disturbed me. If fluid-filled pipes are going to run our cars, what's going to happen to Gus Wil-



son? Don't tell me he'll be replaced by a plumber!

LEWIS T. Scorr, Newark, N. J.

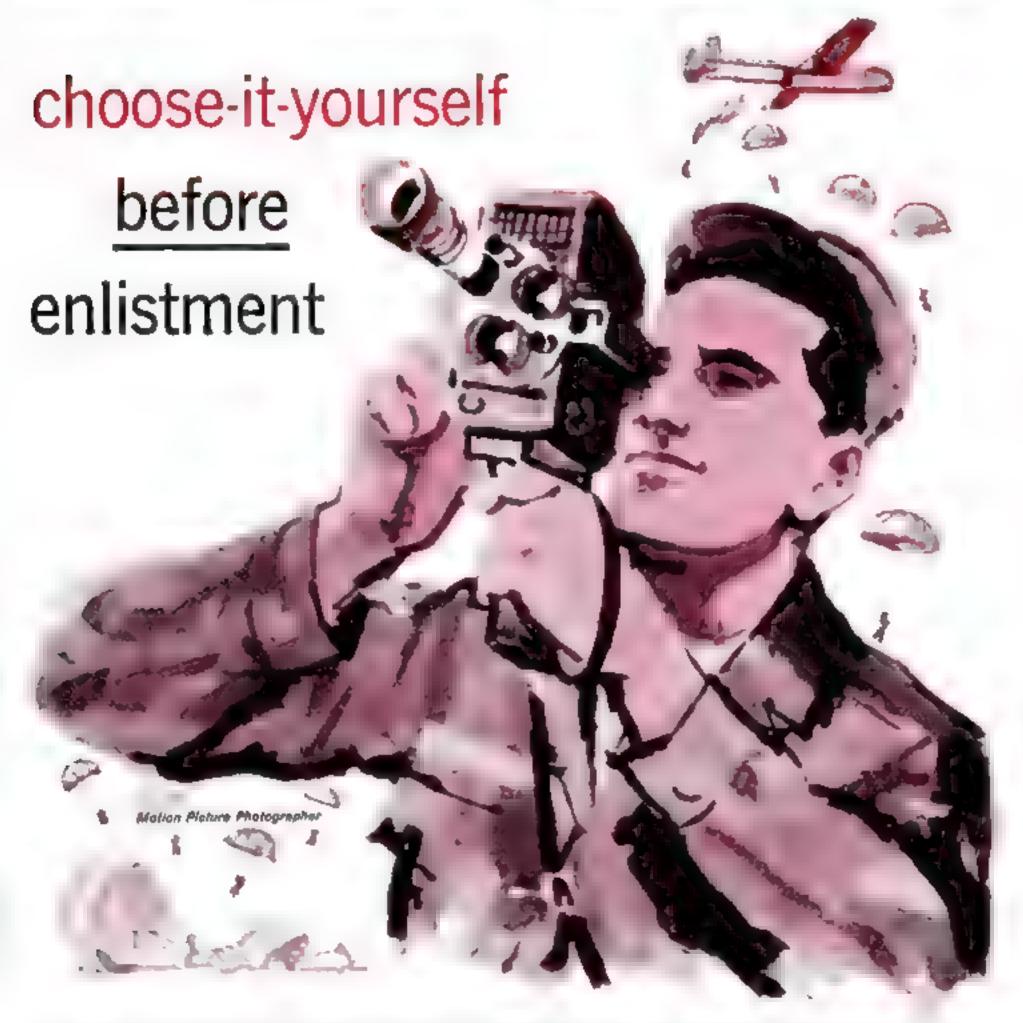
#### How Not to Use a Shaver Cord

RECENTLY I called a TV repairman and when he took off the back of the set he found he had left his plug-in cord at the shop. To save him a trip back, I got out my electric-shaver plug-in cord and to his surprise, it did the job fine. I offer this idea with my compliments to all fix-it-yourselfers who own an electric shaver.

FRANK POLAGE, Floral Park, N. Y.

Not really a fine idea. The light braid used on some shaver cords will not safely

### want training in Photography? Mechanics? Electronics?



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### Train Going Nowhere Fast

Last spring you had plans for building a "Train That Goes Nowhere" [April]. Two weeks ago I got around to building the table and here's a picture of how my train looks.



I had a lot of fun with this project. The whole thing cost me about \$20. The modern locomotives I had on my layout didn't do so well on the table so I bought one of the older models. It works fine

JAMES STEFFNER, Rocky River, Ohio.

### **New Fasts for Old Socks**

A SENSIBLE question is entitled to a practical answer, so here's mine to the fellow who wants to use up his worn-out old socks [June letters]:

Cut the feet off and pull the tops over old fruit jars. Freeze in the deep freeze. Break out the glass and you've got prefabricated post holes ready to plant. With good advertising and bright display packaging, these could prove to be a fast seller. I'd almost bet that merchants would have trouble keeping them on their shelves. I give you the idea free and wish you luck with this handy-dandy business venture.

J. C. SHOLBERG JR., Lake Stevens, Wash.

hands, Sanders can use his old socks as polishing mittens—good for furniture, car, or Venetian blinds.

H. L. KEENES, Snoqualmie, Wash.

... Cur them down the center of the back and use them as grease rags.

SAM WICKHAM, Flagler, Colo.

. . . SNIP off the tops and get your wife

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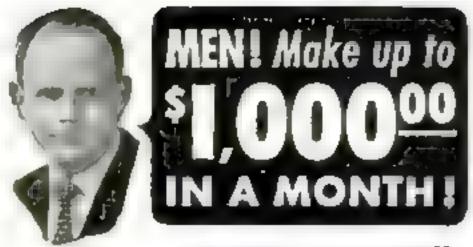
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to sew them into jacket and coat sleeves that lack windbreakers.

VERNA HOWARD, Rockford, Ill.

... Cur the feet off at the heel line and use the rest of the socks to protect shirt cuffs and wrists from grease and grime when working on the car.

H. M. OSBORN, Riverside, Calif.

hand in a sock, pull another on over the first and continue this, using as many socks as needed to



make a sausage-shaped pad. Wherever you need padding or cushioning, you've got it. This also makes a good sleeping companion for a puppy just separated from the litter.

LEO MOL, Keyport, N. J.

... Sur them over the top of a ladder to protect house siding from being marked.

F. L. JONES, Chicago.

... Use nylon socks for straining paint or enamel.

CALVIN HODGE, Boston.

... SAVE the soft, cotton ones to buff with after shining your shoes or polishing the household brass.

JERRY MULTON, Chicago.

... Have your wife sew shut the upper sections, after cutting off the feet, and you have fine covers for the heads of golf clubs.

E. L. West, Mannington, W. Va.

### **Hudson's Backstop Brakes**

A JUNE letter writer asks why somebody doesn't offer auxiliary mechanical brakes on cars, to take over if the hydraulics fail.

From 1948 or earlier, until their demise in 1957, Hudsons were so equipped. The system operated on the rear wheels only, through the emergency-brake cables. It came into play when the brake pedal was pushed within about an inch of the floor. Even though it worked on only two wheels, it was certainly effective, as many Hudson owners will testify.

KERVYN MACH, Wagner, S. D.

... That brake-inventing fellow is talking about the Hudson system—the

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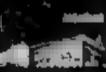
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VETERANS G vedare of discharge

best setup for braking. I was fortunate to have the extra brake on my Hudson when a wheel cylinder went out and the mechanical brakes took over.

ARNO SCHWARZE, Ft. Wayne, Ind.

### Fiyer Count Stepped Up

HERE is a photograph of what, by your count of such known conveyances ["The



World's First Sports Car," June], must be Flyer No. 8. This particular one is believed to be a Brigge & Stratton (both body and motor). Although of uncertain vintage, it's in excellent running order.

S. G. TAYLOR, S. Dartmouth, Mass.

... I own a 1921 Flyer. A hand-medown through the family, it is in almost completely restored condition and was

licensed up until last April. I still have the original bill of sale and many spare parts for the 1½-hp. engine.

Your listing of other owners should be most helpful for trading parts. My thanks for your article—the first I've ever seen on the subject.

BILL SCHBOEDER, Summit, N. J.

Adding the Flyer owned by Elliott Neuberg of Chicago ["PS Readers Talk Back," Sept.], the count jumps to 11.

### Freeze it, it's Still Fast

REPLYING to one of your letter writers [July], you say that cold has no influence on the speed of light. Under the circumstances he describes. I think you'll find it has-unless my 25-year-old physics has turned sour.

Light alows down when it travels through liquid, gas, or clear solids like glass. Otherwise we'd have no refraction in water, mirages in the desert, or lens systems. We wouldn't be able to see (or we'd have pinhole "lenses").

And if cold makes the gas or liquid more dense, it would have the effect of increasing the slowing effect, causing the

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light to bend more on entry. Or is there something I missed?

Tom Booz, Fullerton, Calif.

What we said was correct. Temperature, in itself, has no effect on the velocity of light. The density of the transmitting medium does, of course. So there will be a connection between temperature and light velocity when light travels through any substance.

### Bring Back the Horseless Buggy

LIKE the June letter writer, I too like the idea of an electric buggy; but on design we part company. The Fiat 500 with sun top seems to me a better basic design for a lightweight car than the curved-dash Oldsmobile.

Part of the frame strength could be in the top members and these could be spread to give some of the weather protection of the old-fashioned auto top, eliminating roll-up glass windows. A two-passenger seating pattern like that of the Scripps-Booth car (the driver a bit in advance of the passenger) would save weight.

E. C. BLACK, Columbia, S. C.

### Is Detroit Selling Kits?

My '53 Lincoln, a solid and satisfactory piece of machinery, needed new main bearings after 102,000 miles. Pondering a new car, I questioned friends who had bought cars recently.

One person that I talked with said he had had to go back to the dealer every week for two months to get his new car running right. Another man told me that the door handle came off in his hand the day he drove his treasure home. And a third spent \$4,000 for a car that he says is "remarkable for the way it lets water drain in and gasoline drain out."

Now I'd like to buy an American cara good-sized, comfortable, powerful car that I can drive for 100,000 miles. But I'll be hanged if I'll spend \$4,000 for a kit of do-it-yourself parts, loosely screwed together, that can't be called an automobile until a dealer has worked over it for months. For me the solution has been a rebuilt engine.

When that gives out, in 1965 or 1966, maybe Detroit will be back to building cars, not kits.

THOMAS G. APPEL, Pleasantville, N. Y.

LOOKING FOR LONG WEAR IN SERVICE SHOES?

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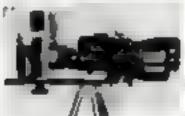
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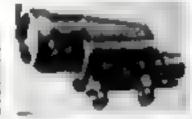
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### The month in science

Ruby that amplifies light. Take a pink rod of ruby crystal . . . flash powerful green light on it . . . shine a weak flicker of red light at one end . . . and out the other end bursts strong red light—the purest, most brilliant red anyone has ever seen.



**SPIRAL LAMP** surrounding ruby rod provides energy that makes new light amplifier operate.

This is a light amplifier, the first ever made. It does for light waves what a vacuum tube does for radio waves (light waves are the same as radio waves, of course, just a billion times smaller). A weak signal (the red flicker) controls a powerful output (the red burst). The "power supply," which sustains the output, is the green light.

The whole thing is as big as a water glass. Its name; laser (stands for "light amplification by stimulated emission of radiation"). It was invented by Hughes Aircraft's young (33) physicist, Dr. Theodore H. Maiman, working along lines pioneered by Prof. Charles H. Townes of Columbia (inventor of the maser, for amplifying very short radio waves).

What good is it? Look:

Television and radio could be broadcast on beams of light waves. The advantage: capacity. Light waves can handle much more traffic because they are so much shorter. Every city could have any number of TV and ra-

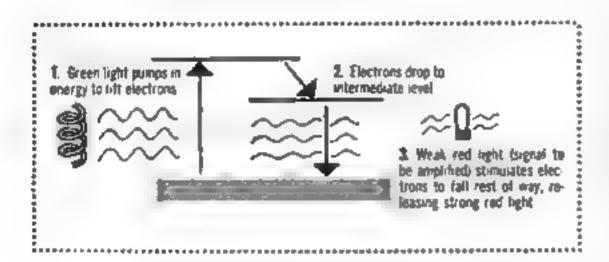
dio stations broadcasting without interference. Transmitting stations would be a spectacular sight, flashing colors like huge, gaudy neon signs.

- Radar that used waves of light would be much more accurate. The ahort waves would give detailed pictures on the scope—like TV pictures—instead of just pips of light.
- ▶ Fantastic searchlights could be made. Light comes out of the laser in an almost perfectly sharp beam that can be focused into a very small spot. If a laser were set up in Los Angeles and focused on San Francisco, its spot of light would spread to only 100 feet in all that distance. An ordinary searchlight beam would spread to a width of 50 miles.
- A death ray is another possibility. The laser's beam can be focused so sharply that a fantastic amount of energy is con-

### The month in science continued

centrated into a pinpoint. It would certainly cook bacteria—to sterdize utensils—and maybe kill people as well.

The laser is another prize won with scientists' new-found ability to make solid crystals perform very useful tricks. The ruby crystal is painstakingly grown to contain just the right atoms in just the right places. Inside it, electrons—the tiny, negatively charged parts of atoms-gain and lose energy. They gain energy by taking it from light waves; they lose energy by throwing out light waves. Regulating these gains and losses makes the ruby amplify. Here's how:



- 1. The green light "pumps in" power, raising the energies of many electrons to one particular high level. Scientists visualize the electrons being lifted, bodily, from a valley floor to a ledge on a cliff (this is only an analogy, not a literally true picture).
- 2. These electrons quickly fall from the high ledge to one a bit lower down. This loss in energy is just wasted,
- 3. The electrons will stay at the new, lower level indefinitely. But if just a few new electrons come up from the valley floor to that ledge (boosted up by the faint signal input), the newcomers push the whole crowd off. All electrons at that halfway level fall to the valley floor together. They all lose energy together, and this loss appears as a strong burst of pure red light—the output.

The first laser works only with green "pumping" light and a red input-it is a single-frequency amplifier. Tunable lasers that operate over a range of frequencies (or colors) are being worked on.

And how happy are you? The image of the American family lounging around the back-yard swimming pool in a rosy glow of togetherness is pretty close to right. That's the finding of a nationwide study conducted by the University of Michigan Survey Research Center at the request of Congress (and detailed in a new book Americans View Their Mental Health, Basic Books, NYC, \$7.50).

> The interviewers found only one adult in ten admitting that he was "not too happy" More than half the people asked were "pretty happy," and one in three was "very happy." The things they were happy about: family life and material comforts-"enough money, no debts, a nice home."

> There's often a dark cloud near this sunny picture, however. Money again. Almost half the people expressed concern about finances. The worst worriers were those in the middle brackets (annual incomes \$3,000 to \$6,000). Apparently the rich don't need to worry about money, and the poor have given up.



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### PS Puzzlers By Joan Steen

Some hurdles for the nimble-witted . . . Answers on page 234



### Can You Get the World on a String?

MY TASTE in puzzles runs to ones that defy common sense. They startle you into realizing that often what you think should happen doesn't at all. Take this one about the world:

Imagine you have a string 25,000 miles long, just big enough to the around the world at the equator. You proceed to do just that, carefully pulling the line taut.

You find that you've miscalculated slightly and have one extra yard of atring. You decide to fasten the ends together anyway and fudge the extra 36 inches by distributing the slack along the whole length. You figure, quite naturally, that no one will ever notice.

Yet you'd have to be blind not to, because what in fact will happen?



A CLASSIC in the group of logical puzzles is the story of the king and three suitors. The king decided his lovely princess should marry one of them, and to pick out the cleverest he proposed this test:

To each suitor in turn he said, "I may or may not make a mark on each of your foreheads. I will then sit you around a table. Any suitor who sees a mark on any other forehead is to raise his hand. As soon as one of you figures out if he has or hasn't a mark, he should report to me."

There is much cogitation. And then one suitor shouts that he knows he has a mark. How did he come to this conclusion?



Ping-Pong, anyone? It was Sunday afternoon, the last game of the last match in the neighborhood table-tennis tournament. A hard slice bounced the ball off the garage door, hopelessly denting the ball.

"Uh-uh," said Bill to his partner Jim. "That's our last ball." He turned to the crowd. "Anyone got any ideas how to fix it? Can't

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### PS Puzzlers

buy any more on Sunday."

A few spectators came up with ideas, none of which worked. Then Jim said, "Wait—give me five minutes and I think I can do it"

He went into the house Five minutes later he was back with the ball all nice and round again. What had he done? A LITTLE intuition is all you need to solve this "chess" problem:

A chessboard is an eight-by eight square containing 64 alternating red and black squares. Suppose two of the squares are cut out: one from the upper left-hand corner, one from the lower right. Can you now take 31 dominoes, each of which is a two-by-one rectangle, and completely fill the slightly altered board?

Hint: You don't need to use formulas nor even make a diagram to solve this one. A mental pic-

ture is all that you need.

HERE'S a pair of visual puzzles to play with no equations, no complicated logic, just some pencil doodling:

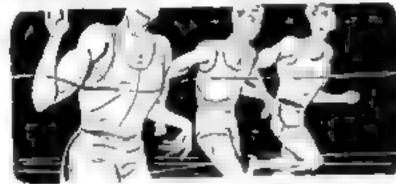
How many pieces can you cut the circle into, using four straight lines?

.....



Remove exactly 10 dots and leave three • in each row, each column, and along • the main diagonals.

### Puzzle of the month



TALK about puzzles that defy common sense! Here's a dandy. Some information must be missing!

Our old friends A, B, and C were engaged in track-and-field events one fine fall day. They amassed points for first, second, and third places as follows:

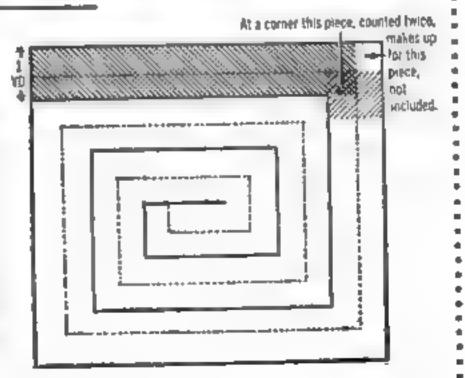
A: 22 points B: 9 points

C: 9 points.

True to form, A was top scorer. B got first in javelin throwing. Who placed second in the 100-yard dash? (Answer next month.)

Answer to fast month's P.O.T.M. What are the dimensions of an oblong garden half a yard longer than wide, consisting of a gravel walk spirally arranged a yard wide and two miles and half a furlong lange?

The trick to this puzzle is to realize that as you walk down the center of the path you trace out the area of the garden. The path is one yard wide so for every yard you walk you cover one square yard of area. At the corners you still walk a yard to cover a square yard of corner (See diagram.) Thus you need only solve the equation:  $(x)(x+\frac{1}{2})=3.630$  (changing miles and furlongs to yards). Work this out and you get the dimensions—60 by  $60\frac{1}{2}$  yards.







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### Problem in wing tanks

This man is putting a finish on the fairings of a plastic wing-tip tank for a British Canberra jet bomber. Each of the paired tanks holds 250 Imperial gallons. Plastic fuel-drop tanks, pioneered in Britain, are said to be just as strong as metal ones, but easier to handle.



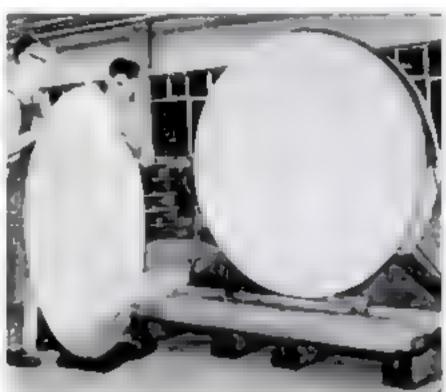
### Pedal-powered ponycarts

For a small fee, Roman children can hire a pedal-powered ponycart for a drive in the Borghese Gardens, Here an owner leads his stable of high-steppers across a cobbled street in Rome, heading for the park and a day's business.



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Placed in a bunker beneath a target area, this Army device records accres automatically. As GIs blast away, solenoids on the targets transmit information to the recorder. It can service up to 20 targets at a time, penning accurate graphs of the day's shooting for later study.



### Glass cut with bandsaw

The big disk at right, being packed for shipment in an English optical works, is 58 inches across, 12 inches thick. Its two faces were accurately cut with a bandsaw in four days. Grinding would have taken about three weeks.

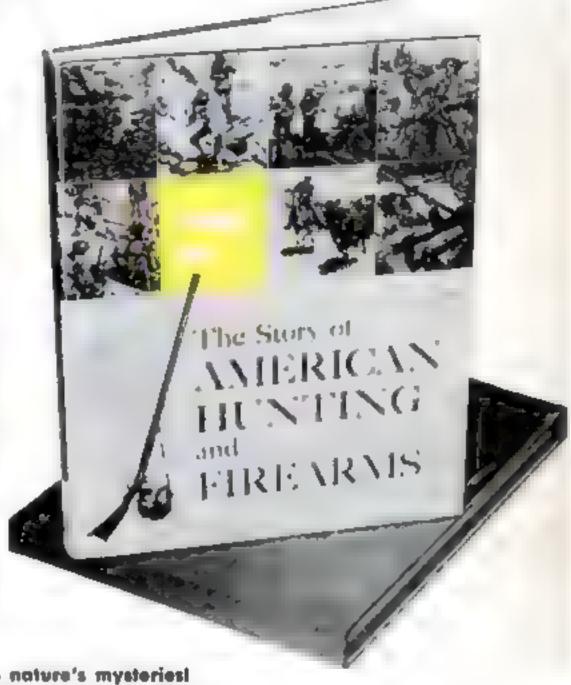
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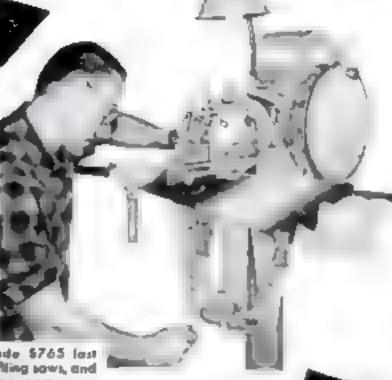
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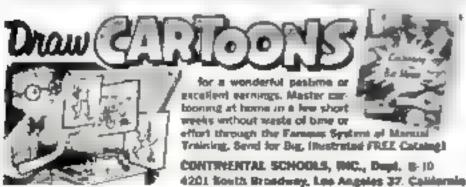
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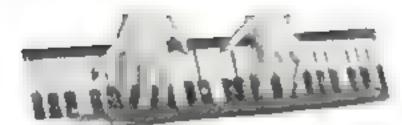
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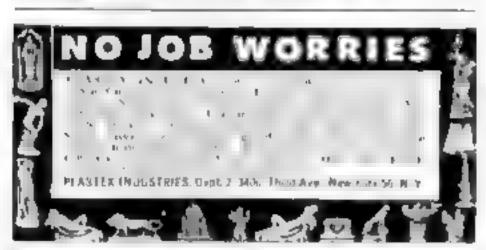
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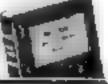
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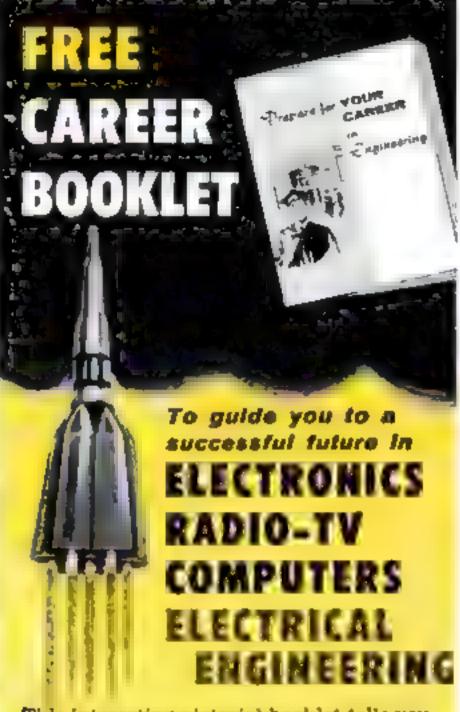


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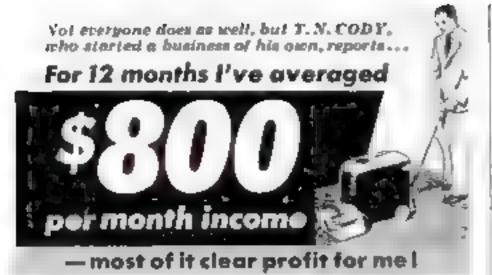
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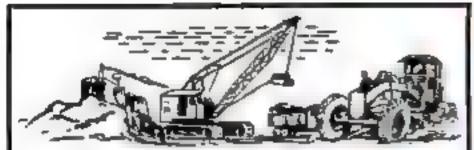
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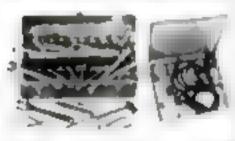


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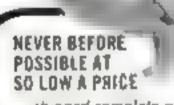
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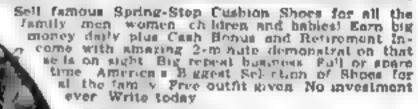
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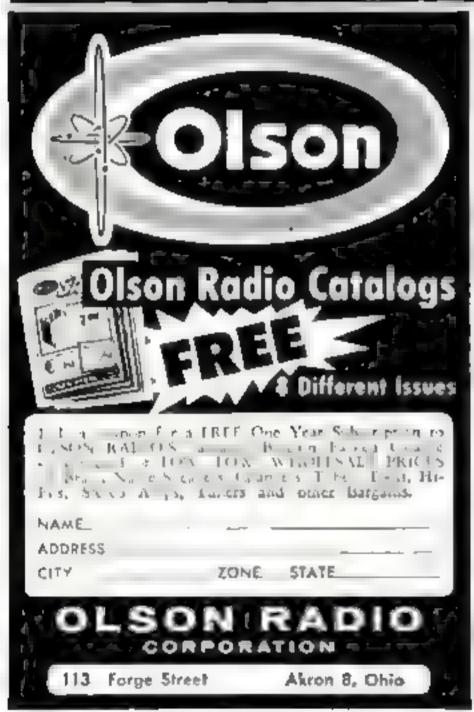
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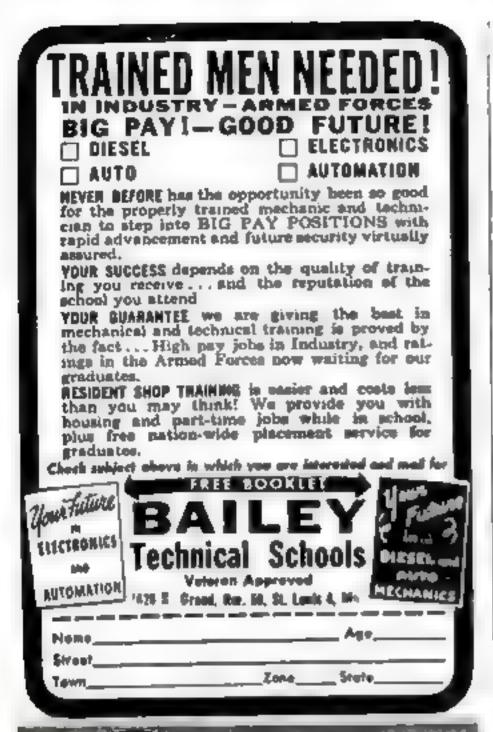
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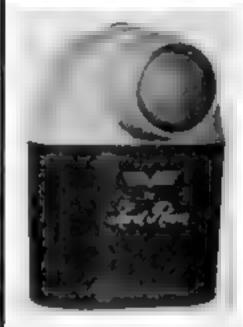
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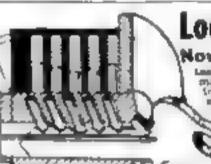
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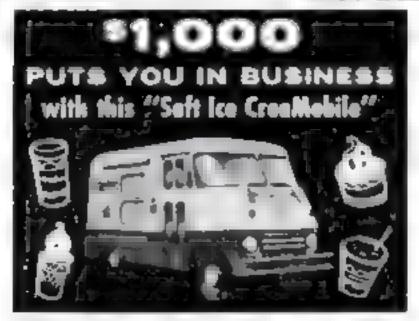
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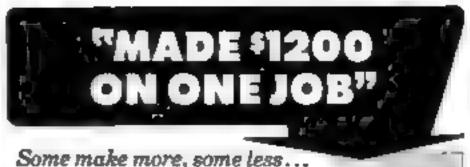
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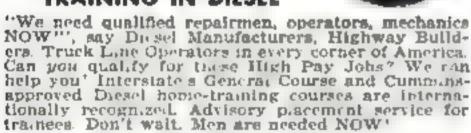
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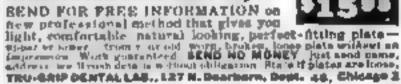


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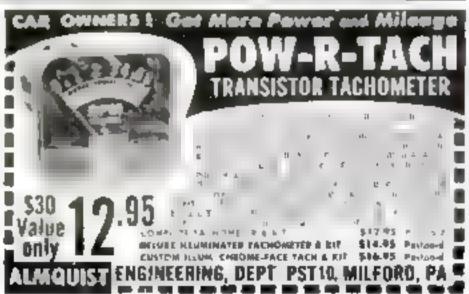


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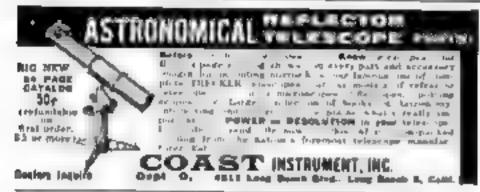
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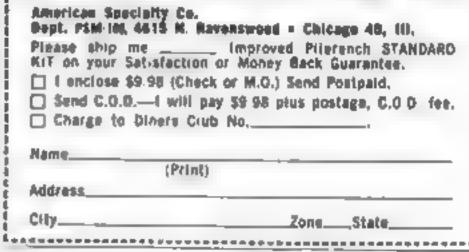
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- All entries will be judged by The Bruce, Richards Corporation, an independent judging organization, according to how well the project answered a specific requirement and the project's overall inventiveness. All projects are eligible no matter how small. Writing ability and quality of the photograph or sketch are not significant.
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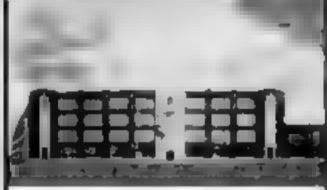
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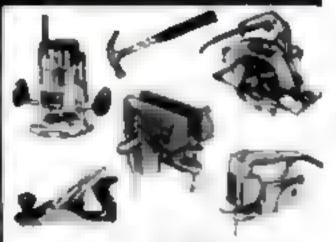
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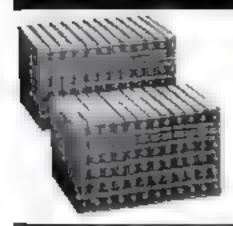


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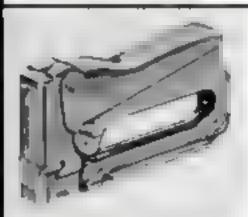
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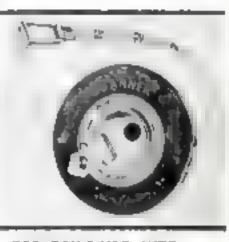


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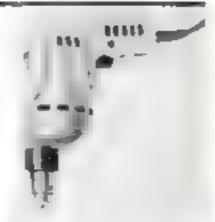


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# German Engine for Tiny Ford?

THE small Ford expected sometime in 1961 may use an engine, and possibly other drive components, made in Europe by Ford of Germany. The engineplanned, engineered, and now being tested in the U. S.—could be built in Germany and shipped to this country at less cost than it could be made here, according to some sources. Ford is also considering a German-built transmission for the small car-which will compete in the VW-Renault-Anglia price-and-size range,



Small-car aches and pains. The switch from a big car to a small one may cause bodily pain to a driver, warns Dr. J. F. Strauss Jr. of Chicago, Dr. Strauss recently has treated patients who had developed aches in the chest, hip, or back a day or two after the switch in cars.

The pains result from changes in driving positions and habits (shifting gears, perhaps), the doctor explained. The difficulties were not limited to six-footers; only one of his patients was over five-feet-ten. "Symptoms . . . may require as long as two or three weeks to subside," he adds.

Recipe: stainless-steel engine. Take a batch of stainless stampings, add several cups of copper foil and wire, then bake in a 2,100-degree oven. Result? A lightweight, powerful, four-cylinder engine that develops up to one horsepower per pound and more than one horsepower per cubic inch.

The stainless-steel engine, developed by

Lloyd Taylor, designer of the postwar Crosley "Cobra" engine, features a combination cylinder block and head assembly-formed not by casting in the conventional way, but by welding and furnacebrazing together thin steel sheets. Since the steel sheets have a uniform wall thickness, "hot spots" caused by uneven metal concentrations don't occur. The thin

New! And looks it! If you've been waiting for your dream motor, wait no more. Evinrude's all new Starflite III is here. What does it offer? The might of 75 hp! The smoothness of a V-4 engine! The speed of Jetstream Drive! The quiet of sound-sealed, cushioned power!

New fixed-jet carburetion is combined, for the first time, with thermostat-controlled engine temperature for the ultimate in efficient, fool-proof performance. A new AC generator, with transistorized regulation, lets you enjoy all the latest electrical accessories with never a worry about battery drain. EVINRUDES

For 1961... Evinrude presents two brilliant Starflite models, a new, luxury-

performing 40 hp Lark, the "big buy" 40 hp Big Twin, and four other models of efficiency from 3 to 18 hp.

Fall is your best time of all to drive a good boating bargain. See your Evinrude dealer now. Ask for your FREE 24-page 1961 catalog, or write: Evinrude Motors, 4018 N. 27th St., Milwaukee 16, Wis. (In Canada: Peterborough, Ont.) A Division of Outboard Marine Corp.



the new 1961

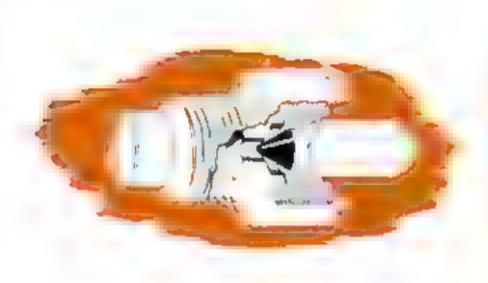
in front!

are out

#### **DETROIT REPORT continued**

stampings dissipate heat more rapidly than thicker castings, reducing pre-ignition or "knock" and permitting very high compression ratios (12:1; 14:1 optional).

The engine, reportedly near production by Tyce Engineering Corp. in California, has dual overhead cams and can be made in four displacement sizes merely by changing crankshafts. The 3½-inch bore stays the same. The four engine sizes and horsepower ratings are: 91 cu, in., 115 hp.; 105 cu, in., 125 hp.; 120 cu, in., 150 hp.; 135 cu, in., 175 hp. First installations will be in boats, sports cars, and race cars.



Holding back the flood. A rubbertipped needle valve that eliminates carburetor flooding caused by foreign material jamming the needle seat is being used on all 1961 Chrysler-built cars.

With conventional steel-tipped needle valves, a tiny particle wedged in the valve seat can prevent the valve from closing fully—and fuel trickles through, flooding the carburetor. The Chrysler rubber-tipped valve simply envelops small particles and closes firmly.

Glass fuel tanks? The trucking industry's search for ways to increase payloads may pave the way for reinforced fiber-glass to replace steel in diesel-fuel and air-brake tanks on many over-theroad tractors. Fiber-glass tanks are much lighter: a 100-gailon model weighs less than 70 lb., compared with steel's 160 lb.

Other advantages of fiber-glass tanks include high resistance to rupture under shock, resilience that minimizes failure caused by vibration-induced fatigue, and, because they are nonsparking and nonconductors of electricity, less fire hazard.

### California anti-smoggers (cont.).

Detroit hopes to tone down cars-causesmog complaints from Californians, if not smog itself, by installing fume-reducing crankcase breathers on all 1961 cars sold in the state.

The "emission reduction systems," their flossy official name, pull crankcase vapors (which otherwise would be discharged into the air as unburned hydrocarbons) into the intake manifold when manifold vacuum is low. Vapors then flow into the

cylinders and are burned. A valve restricts vapor flow at idle when it might make the fuel mixture too lean. The valve also retricts reverse flow of the blow-by gasses. The positive crankcase breathers have no effect on exhaust fumes, biggest source of hydrocarbons and other amog-producing

In addition to being "mandatory options" on all California cars, the breathers will be standard equipment for some models, voluntary options for others.

Now it's compact trucks. Ford's Falcon Ranchero pickup, introduced earlier this year, is just a sample of what's coming in trucks later this fall. Both Ford and Chevy are ready to hit the showrooms with a complete series of light trucks using engines, transmissions, and running gear

lifted whole from their compact cars.

Among the new lightweight haulers are pickups that can be loaded from the sides as easily as the rear, small vans, and handsome panel delivery vehicles. Low first cost, good fuel economy, and excellent maneuverability will be major selling points.

# A new kind of cushion against wear and repair



# DETROIT DEMANDS IT! KENDALL HAS IT!

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Today's automotive engines are the most efficient in history. Built into them is the smoothest, quietest flow of power ever offered motorists. But, automotive engineers state that the continued enjoyment of these features demands the protection of a motor oil above and beyond all former quality standards.

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Refined from the richest 100% Pennsylvania Crude Oil, here is an all-weather motor oil that simultaneously solves combustion chamber deposits, valve lifter sticking, cold engine sludge and hot engine varnish. By minimizing weat, it minimizes repair. The economy of its quality is further enhanced by giving you more miles per gallon of gasoline, too.

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# Remember how great cigarettes used to taste?

# LUCKIES STILL DO

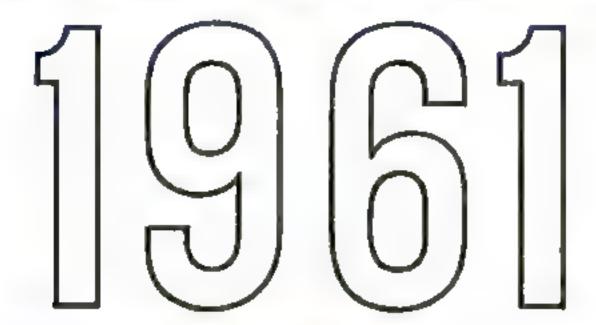


**CHANGE TO LUCKIES** 

TOBACCO AND TASTE TOO FINE TO FILTER

and get some taste for a change!

Again, compacts are the hot news—new makes, new models, a sizzling new V-8 engine...The blg cars? Surprise—they're shrinking—but loaded with fresh gadgetry...On the following 24 pages, PS gives you the Big Picture for...



# new cars

Compacts come hot now. Spectacular performers are the BOP cars, the Corvair offspring for Buick, Oldsmobile, and Pontiac. Here's your first look at the Special, F-85, and Tempest.

"Driving the Buick Special is a delight," says Devon Francia. He tells why in his exclusive report from the driver's seat.

Dodge has a compact this year, too: Lancer.

Big cars also make news—amalier outside but not inside, sprinkled with mechanical innovations.

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# new engines

The BOP compacts are hot cars because they have brand-new V-8s - made of aluminum to eliminate dead weight. Here's an inside view of this radical power plant,

And another new engine. Studebaker gets rid of the old flathead, readies an OHV six for Lark.

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# new ideas

Do you know which week to shop for the best deal on a new car? Which accessories save you money? It's all in "Six Ways to Save Money Buying a New Car."

You can stay away from the lemons if you know how to be your own test driver.

And safety. Have they cut corners in the rush to cut size and weight? Here are the facts from safety expert Paul Kearney. PAGE 85

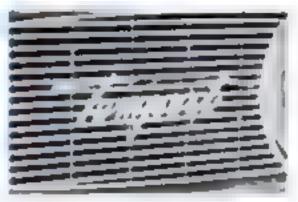
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### GM's New Entries: the "BOP" Cars







# Buick, Olds, Pontiac Go Compact

Here are the hottest little cars to come down the pike in years—and there's an aluminum V-8 that cuts engine weight in half

### By Ken Fermoyle

Your now getting your first look at three brand-new automobiles. They wear nameplates that for a decade have signified bulk, frills, and power. The new ones are not big or gaudy. Powerful they are.

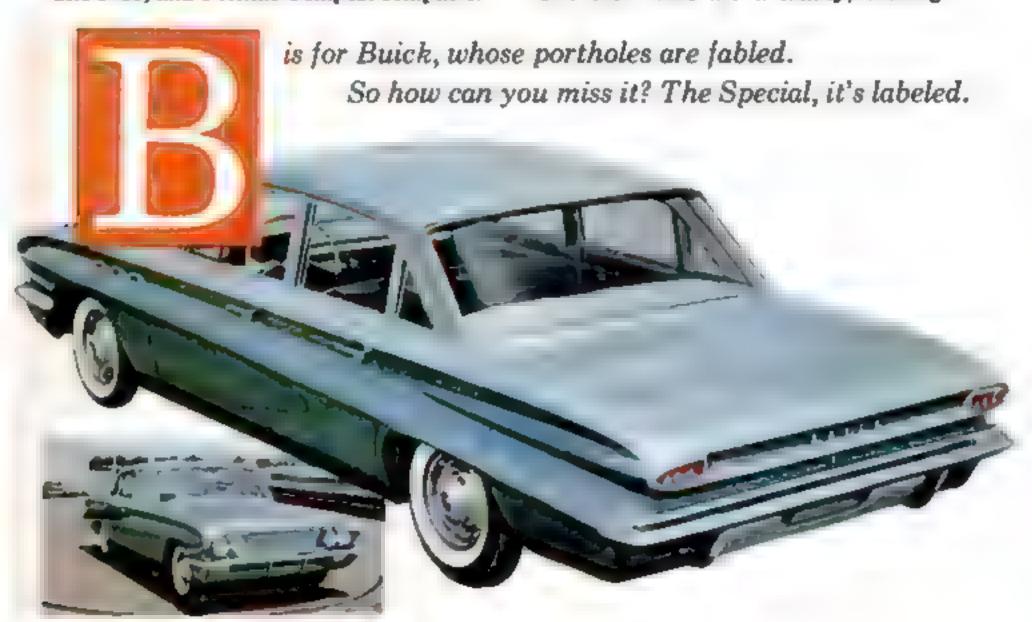
These are the Buick Special, Oldsmobile F-85, and Pontiac Tempest compacts.

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All are much smaller, more economical, and lower in price than their big brothers.

The power comes with another innovation: a V-8 engine made of aluminum. It develops 155 or more horsepower from 215 cubic inches (3½-inch bore, 24/5-inch stroke). The big thing: It weighs just 350 pounds, half as much as a standard cast-iron engine like the Olds Rocket.

The BOP cars are a family, sharing





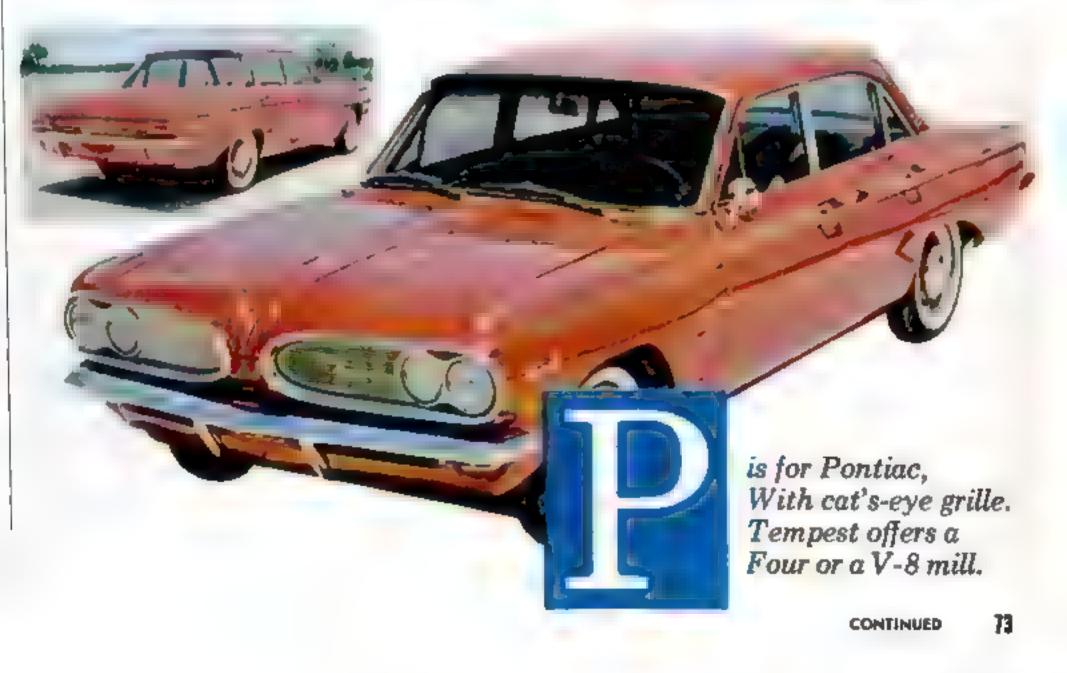
many parts and features (dimensions of all three are almost identical inside and out). But they differ in details. They share nothing with big Buicks, Pontiacs, and Oldsmobiles except names and dealers.

Here's what they're like:

 Size. They are right in the middle of the compact class: a bit bigger than Corvair and Rambler American, smaller than Comet and Rambler Six. Wheelbase is 112 inches, overall length about 189 inches. Inside, they are roomy. Leg room and head room almost match big-car dimensions, but hip room and shoulder room are about two inches less.

 Power. That half-weight hot engine zips the BOP cars away from any other compact (except the Lark V-8). They outscoot many full-size makes.

Economy. The BOP compacts run



### No look-alikes, BOP cars differ inside and out













FAMILY RESEMBLANCE SHOWS, but sculptured lines in the body sides and fenders, plus individually styled dashes and interiors, help give

each BOP compact its own identity. Stylists used chrome trim less lavishly than on the bigger cars—they couldn't afford it.

25 percent farther on a gallon of gas than their big brothers, but not quite as far as less powerful compacts. Mileage should average 19 to 22 m.p.g.

 Looks. They are not stripped models, but handsome, well-appointed cars uncluttered by ostentatious gimmicks. (A lot of people will like that.)

• Cost. Base prices should start around \$2,200 to \$2,400 (the cheapest 1960 Buick was more than \$2,700). But by the time you get one delivered with automatic transmission and other oddments, you'll be lucky if the bill is less than \$3,000.

The differences. You won't have any trouble telling the BOP cars apart on the road. Grilles, hoods, rear decks, and side panels are all distinctively individual, as the photos show. Under the skin there are

significant variations among them, too:

• Pontiac Tempest. The basic car comes with the four-cylinder engine (split from the big Pontiac's standard V-8—as described last month in PS) and a floor-mounted stick shift. The bigger aluminum V-8 (identical with Buick's) is an extra-cost option. The Tempest has the unique transaxle we also described last month: Its transmission is located at the rear axle and connected to the engine by a slim, flexing shaft. This makes possible an almost flat floor—no transmission hump, a vestigial drive tunnel—and also independent springing for rear wheels.

 Olds F-85. The standard job is the aluminum V-8, rated at 155 hp. at 4,800 r.p.m., using a two-barrel carb, regular gas, and an 8.75:1 compression ratio. They'll

### ... And here are the BOP station wagons













FOUR-DOOR MODELS ALL, wagons have a lifth door at the rear. It is one piece, hinged at top to lift straight up. In the Olds F-85, the rear

window rolls down (there's a power option). The window is fixed in the other makes. Wagon fans may miss the length-adding tailgate.

also sell you a power pack (four-barrel carb and 10:1 compression-ratio head, giving approximately 175 hp.). The automatic transmission (optional) is a scaled-down Hydra-Matic with a new twist—a variable ratio in first gear.

• Buick Special. The aluminum V-8 is standard again, rated at 155 hp. but at 4,400 r.p.m. The optional transmission is a smaller, lighter—tricked up—Dynaflow. It gains efficiency at higher speeds by routing some torque around the converter through a direct mechanical linkage to the output shaft.

The engine. Aluminum power plants have a long and troubled history in Detroit. This one first came out of GM Research more than three years ago. It is a conventional design—90-degree V—that

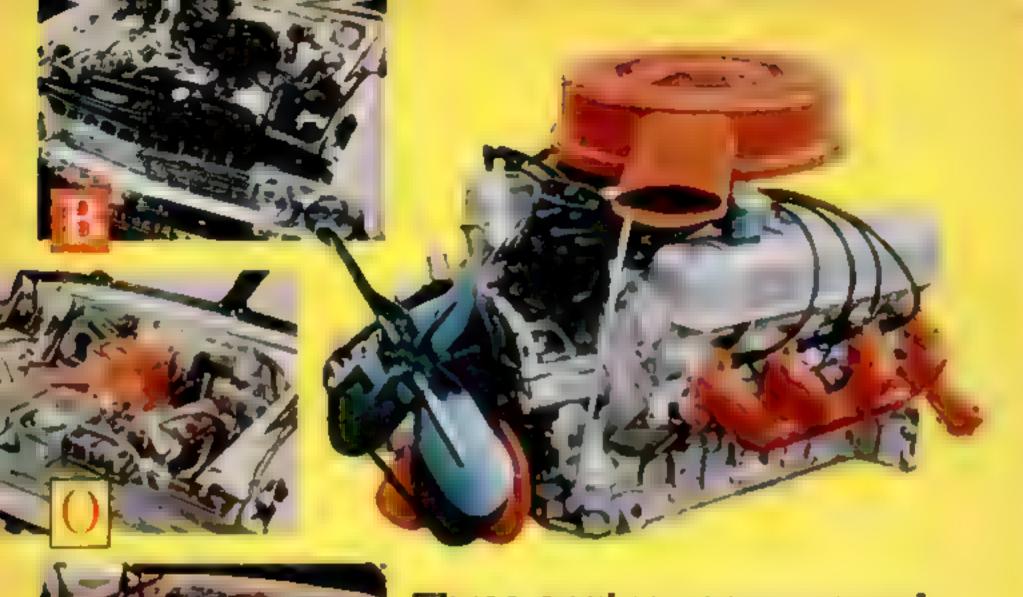
combines familiar features from many cast-iron engines.

Revealed a Buick man: "One problem was caused by the different rates of expansion between aluminum in the block area surrounding the upper part of the crankshaft bearings and the cast-iron bearing caps. We got distortion and the bearings went out of round. You can figure what this did to crankshafts."

The solution: They beefed up the bearing caps, making them rigid enough to hold the aluminum sections in line.

Early aluminum castings were porous. They leaked. So special impregnating compounds had to be brewed. (Cast-iron engines require impregnators, too, but different kinds.)

The new engine is of course not all





### Three engine rooms reveal separate approaches

THERE'S LOTS OF SPACE around the four-cylinder mill in the Tempest at left. Olds and Buick V-8s come closer to filling their engine rooms, though the plugs, happily, can still be pulled without trouble. Note variation in battery placement, Cast-iron four outweight the aluminum V-8s by about 120 pounds, has less horsepower but more torque in lower speed ranges. It should be cheaper to build. The aluminum V-8 above is Buick's version.

aluminum. Cast iron is used in areas of heavy wear and load—cylinder-bore liners, valve guides, exhaust manifolds, and main bearing caps, for example. The camshaft is cast of a special chrome-nickel-iron alloy. The crankshaft is Armasteel, a heattreated cast iron.

The dry cylinder liners are 3/16-inch iron, with grooves around their outer surfaces. The aluminum block is cast around the liners, gripping them permanently by the grooves.

Both Buick and Olds accepted this basic block. Thereafter they went their own ways, capping the block with different cylinder heads and valve setups.

Olds engineers stuck with the same wedge-shaped combustion chamber that they have been using in their big Rocket V-8s. They knew it was dependable. It is also amenable to souping up (with the high-compression power pack that Olds offers).

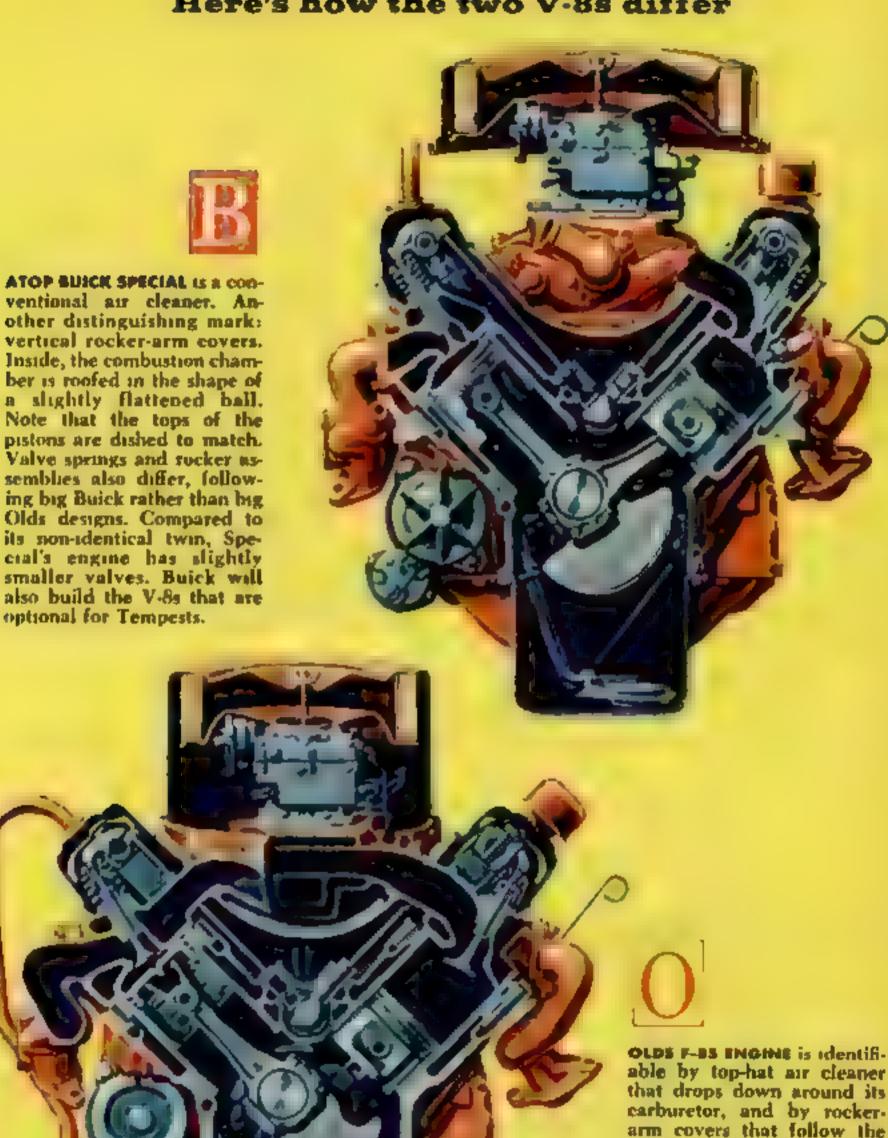
The Buick men aimed for efficiency and economy. They shaped the combustion chamber to a pinched, flattened ball. The idea was to provide greater volume with less surface area. That reduces heat losses and converts more of the burning energy into usable power.

When you lift the hoods, the most noticeable difference between the Olds and Buick engines is their air cleaners. Buick is conservative, using the conventional upright type. Olds' air cleaner, however, clamps down on the intake manifold, completely covering and surrounding the carburetor. The advantages: protection for the carb, better silencing, and more uniform fuel temperature (faster warm-up, cooler cruising).

The water-jacketed intake manifolds also look different, but that's to accommodate the air cleaners. Inside, they're the same "split-level" design.

[Continued on page 244]

### Here's how the two V-8s differ



able by top-hat air cleaner that drops down around its carburetor, and by rockerarm covers that follow the lines of the 90-degree vee. Most important internal difference a wedge-shaped combustion chamber with a "squish" area, as in the big Olds. Both engines drink standard gasoline, though a power-pack version of this one will need premium.

### Restyled Ford needs fewer grease

THE new Ford is new on the surface and beneath. It looks different: more conservative and smaller. Length has shrunk four inches (to 210), width 1.6 inches (to 79.9). But inside, space for

passengers and their luggage is the same. Significant mechanical changes show up, too.

There are no grease fittings. Factoryapplied molybdenum disulfide grease



### De-finned Plymouth starts, steers,

Plymouth an entirely different look for 1961. Stylists chopped off the flamboyant fins and created a broad, flat rear deck. The full-width grille is gone.

Engineers concentrated on the electrical system, steering, and gearboxes.

A new starter works more quietly. It also has an over-running clutch to protect the starter armature against overspeeding



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### jobs, oil changes

keeps the chassis lubricated for about two years. Then you'll have to unscrew plugs, install fittings, and greese it.

Oil changes are set at 6,000 miles. For most people, that will mean no change until the weather requires it.

Side windows no longer have laminated safety glass, but tempered sheet, which is stronger. When it does go, it breaks in a checkered pattern without splinters.

Besides the familiar 292- and 352-cu.-in. V-8s, there are two substantially reworked power plants.

 A husky 390-cu.-in. V-8 becomes the biggest, most powerful engine Ford has ever built for standard passenger cars. Basically it's the 352-inch V-8, bored to 4.05 and stroked to 3.78 inches.

• The 223-cu.-in. six comes with new rocker arms designed to keep valves quiet. The trick is a spring-loaded cam that compensates for wear and heat expansion. You may see this system on more Ford engines later (it's cheaper than hydraulic valve lifters).





FORD TRADEMARK—big round tail lights—makes the '61 easy to spot from rear. Front view is distunctive, too: higher, narrower hood, concave grille, wide-spaced lamps, flat roof.

### shifts easier

if you hold the ignition key in "start" position after the engine fires.

A new lightweight distributor has an aluminum housing. Nylon in the breaker points reduces friction; they are lighter, too, and have less tendency to "bounce" at high speed.

Plymouth also has the new generator that makes alternating instead of direct current. It saves weight, produces more juice for stop-and-go driving.

A heavy-duty three-speed manual transmission is now standard equipment for all 361- and 383-cu.-in. V-8a, and also for the 318-cu.-in. job when equipped with power pack. It is synchronized in second and high gears only.

A fabric-reinforced rubber coupling between the steering gear and shaft on manual-steering cars acts as a universal joint to accommodate variations in alignment. Result: amouther steering. Power-steering cars have a self-tightening belt device that is supposed to reduce belt slippage, improve steering feel, and prolong belt life.





SWEEPING CURVES accent the '61 Plymouth's narrower, higher grille and form eyebrows over the dual headlamps. Small center ridge in rear dock replaces the high tail fins of past years.

### Dodge





THE fins remain, but just barely. Instead of flaring skyward, they slope off at the rear to outline the side-curving tail lights. The front is simpler, with a concave, slotted grille. Mechanical innards and dimensions vary only slightly from 1960. This year there's only one Dodge: the Polara.

### Buick

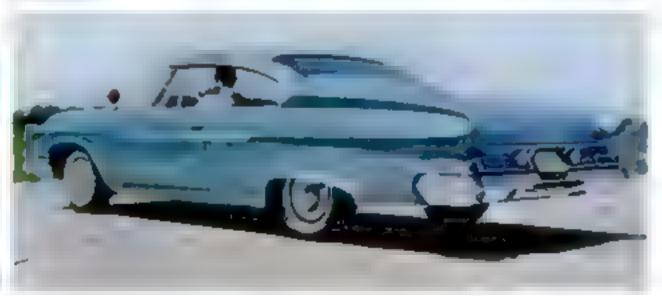




SLIGHTLY higher rooflines and elimination of the dogleg in the front-door opening let you climb in and out more easily. Styling emphasizes the massive look that was a Buick trademark during the make's most successful years. The portholes are back and fancier than ever. Engineering is little changed.

### Dart





THE hot-selling Dart is one of the few '61 cars to grow in size. It's longer and wider—but by less than an inch. It shares with big-brother Dodge a neat, concave grille and low-flying fins. Like the rest of the Chrysler line, it uses the lightweight AC generator that first showed up last year on Valiant.

### DeSoto





Desprix all rumors, the DeSoto refuses to die—although only the Adventurer series survives, little changed, for 1961. Identify it by an unusual split-level grille, with a protruding fine-mesh top and an eggcrate rectangle below. Canted dual headlamps flank the grille. The fins soar high as ever.

### Pontiac





A NEW, more rigid "perimeter" frame hugs the outline of the '61 Pontiac's narrower, shorter body. The side rails extend out under the rocker panels—to act as buffers in case the car is hit from the side. Stylists straightened the front pillars (no dogleg), then topped the pillars with a new roof.

### Imperial





IMPERIAL brings back the past with freestanding, cast-aluminum headlamps, "suggestive of the road lamps of classic automobiles," according to the biurbs. The fancier-than-ever tail fins bring you right back to the present. Among the nuts-andbolts changes: a gearless, magnetic-drive speedometer.

### Lancer: New Compact from Chrysler





Dobge's new compact wears a different face and bustle, but its body is the same as the Plymouth Valiant's. You can tell the near-twins apart by the Lancer's full-width grille, ridged rear deck lid, modest round tail lights, and reverse-curved side trim.

Mechanically, the two compacts are nearly identical. Both use the same 170-cu.-in. slant six. But the Lancer has a power option for drivers who like their engines hot: the peppy 225-cu.-in. six that ordinarily comes in Plymoutha and Darts.

### Falcon





You get your choice of engines with Falcon now. The 144-cu.-in. aix is still standard, but a more powerful 170-cu.-in. job, developed originally for Comet, is also

available. Other changes are slight: a onepiece aluminum grille, heavier steel in the upper door frames (for rigidity), softer rear springs.

### Valiant





A rew chrome bars on the rear fenders and bigger squares in the Chrysler 300style grille are the only exterior changes in the 1961 Valiant. The 170-cu.-in. engine has a slightly lower compression ratio (8.2:1 vs. 8.5:1 in '60) so it won't gag at the low-octane regular gas sold in some parts of the country.

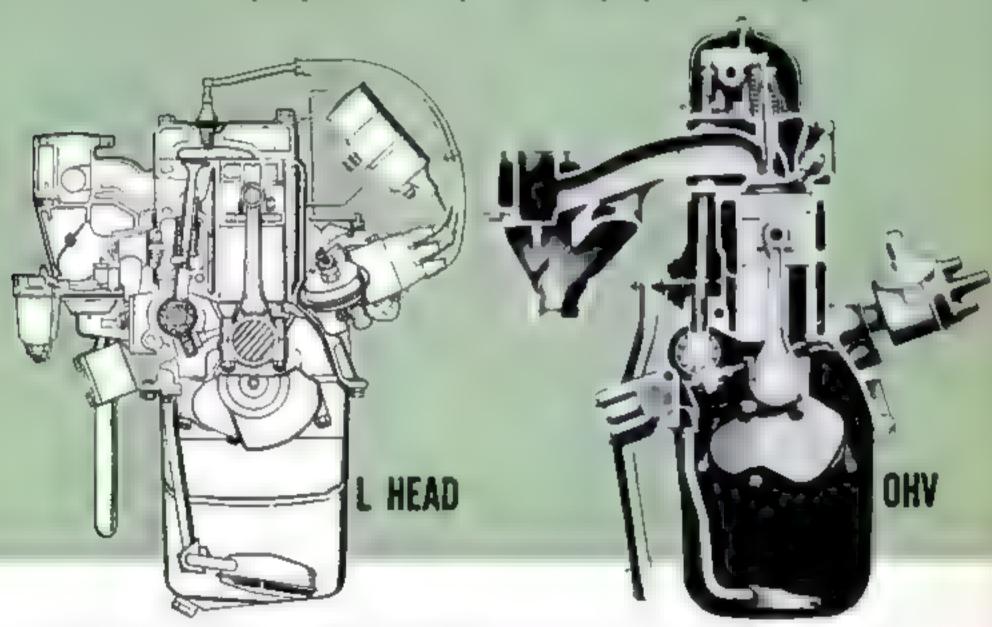


Lark Gets 112-Hp. OHV Engine

FLATHEAD engines go one step further toward history this year. Studebaker has remodeled its faithful old sixcylinder power plant, around for decades, with fancy new overhead valves.

The new Lark engine produces 112 hp.

at 4,500 r p.m. from 170-cu.-in. displacement. Torque is 154 lb.-ft, at 2,000 r.p.m. That's a jump over the old mill, which got 90 hp. and 145 lb.-ft. from essentially the same block. Compression ratio is 8.5 1. Styling is little changed.



### Optional Engine Adds Zoom to Comet

Performance is the 1961 bonus for Comet. It can be had with an optional engine (the standard one, stroked .44 inch to 170-cu.-in. displacement). The longer stroke gives some extra horsepower, but mainly boosts torque to improve hill climbing. The ratings are 101 hp. and 156 lb.-ft., compared with 85 hp. and 134 lb,-ft. for the standard job.



1961	RAMBLER VALIANT	108 0 106 5	189 B 184.0	724 704	па. 2,748	6 50x15 6 50x13	37.3 37.1	n.p 21.3		OHY 6 30"-Incl ned	195 6 170 0	127(年4,200 101(日4,400	215@4,900* 148@5,200	0.8 27.2	180@1 600 155@2,400	87 82		57.7 54.6	57.8 54.1	35.0 33.6	34.0 33.4	99.8	1	1 56	99
OR	RAMBLEN PARKERICAN	300 0	1231	70.0	* =	6 00×15	36.0	B.A		1 head 6	195.6	90(4.3,600 12	125@4,200 21	n.a.	160/01.600 18	8.0		515	49.8	350	330	580		45.3	
ESE	PONTIAC TEMPEST	1120	189 3	72.2	2 900	6.00x15	017	\$ 92		45"-inclined OHY 4	194 5	110@3,800	155@4,400*	28.4	160@2,000	19 10		55.2	54.6	340	33.9	50.00		282	
AC	OLDSMOBILE F-85	112.0	156 2	71.6	2,695	6 50x13	37.0	20.7	1	B-A AHO	215.0	155(2)4,800	0.0	17.4	210,02,800	\$ 75		552	54 6	38 2	37.1	58.6		58.2	ANCES
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ĬŌ2	LANCER	106 5	188 \$	72.4	2,750	6 50113	37.1	21.3	ENGINE	30"-Inc. Ined DHV 6	170 0	101@4,400	145(0.4.000	27.2	155 (6.2,400	2.8	DIMENSION	24.0	54.1	346	33.4	56 35		56 9	PERFO
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E	BUICK	112.0	188 4	713	2012	6.50×13	38 1	22 0	I	BIVE THO	215 0	155@4,400	none	17.6	220(0:2,400	8.8		55.2	54 6	34.0	33.9	58.6	1000	29.5	296.2
<b>TPA</b>							AETER (IL)	KE AREA (Ib.)			In.)	M.	ISEPOWER		m.)	(80 1)		Front	Rear	Front	Rear	Front	,	Hear	Mest
CON		WHEELBASE (In.)	OVERALL LENGTH (In)	WIDTH (in)	CURB WEIGHT ( b )	TIRE SIZE	TURNING-CIRCLE DIAMET	WT PERSO IN OF BRAKE		TYPE	DISPLACEMENT (ou In	HORSEPOWER @ R P M.	OPTIONAL EXTRA HORSE	WE GHT PER MP (Ib)	TORGUE (Ib -ft. @ r.p m	COMPRESSION RATIO (10		SHOULDER	800M (in.)	HEAD	ROOM (in )	HIP	ROOM (In.)		

\* 1950 data listed applies to 1961 model with minor exceptions A.a. Information not available

8 8

8 4

25 85

100

100

22

8 8

25 25

24 25

22.5

100

GAS M.LEAGE (m.p.g.)

TOP SPEED (m p h )

P.V-8 engine

# all N

### By Watson Fenimore

Your 1961 car with a little knowhow on buying. Here is what you should know before you step into the salesroom:

- When to buy.
- How to deal with dealers.
- What not to believe in the advertising.
- What models and brands are the best value.
- What accessories are good investments.
  - The ins and outs of financing.
- 1. Choosing the right time to buy. Depending on your car-buying habits, you may get your best dollar deal in late sum-

# 6 Ways to Save Money Buying a New Car

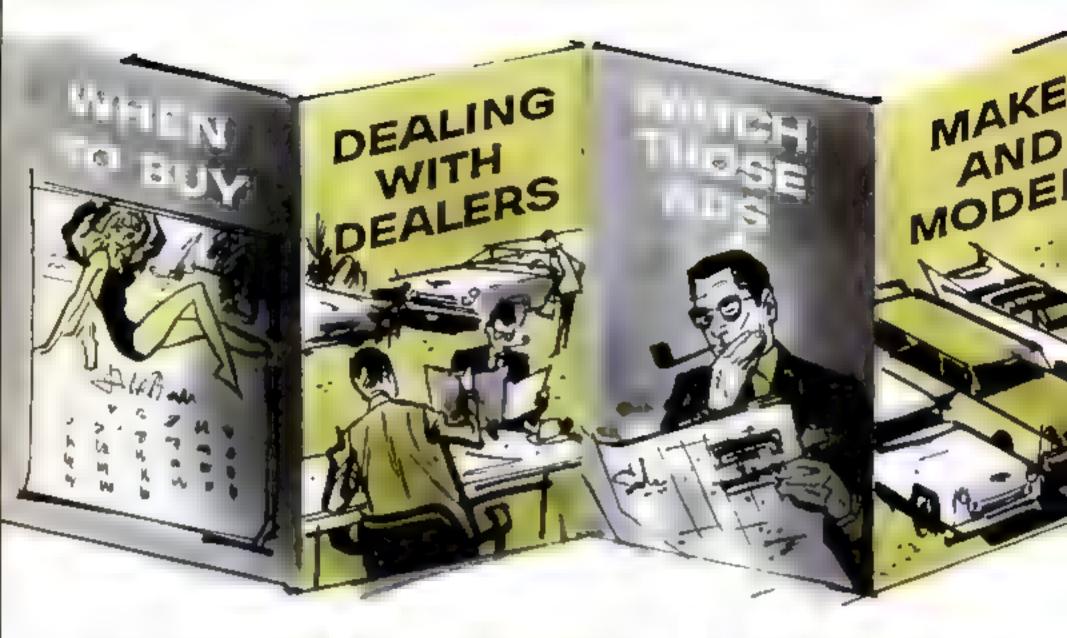
mer or early fall, before the next year's models come out. That's when factories are offering incentives to dealers to move cars. Salesmen can give you an extra \$50 to \$100 over the customary discount. This does have its disadvantage—when the new models arrive, you're driving a last-year's car.

The prime consideration here is how long you plan to drive it. If you're an every-year or every-other-year trader, you're not getting much of a bargain—you take a whole year's depreciation within a few weeks. But if you tend to keep a car for several years, depreciation—spread out over a longer period—is a smaller factor.

Buying right after the new models appear, later in the fall, is not your best bet on a strictly dollar basis. Dealers are not in a mood to talk discounts. Cars may be loaded with extra-cost gadgetry. And, with winter coming on, trade-in value is low. But—the thrill of a new car when the model is fresh as your breakfast egg may outweigh more practical factors. And you do get a full year's driving before the next new model outdates yours.

Midwinter buying is an alternative. Car sales are slow in December, January, and February. Discounts have started.

As for spring and early summer, remember that these are periods of high-



volume sales—especially for convertibles and hardtops—and low discounts.

Buying a new 1960 model after the 1961s have arrived is rarely a bargain. A smart dealer rarely is stuck with expiring models he can't sell; however, he may keep a few in stock for customers who hope to get a sizable discount. The only worthwhile deal on a car such as this is about 30 percent off the list price on the sticker.

Whatever season you choose, buy toward the end of the month. Salesmen are anxious to meet their monthly quotas. Dealers are liberal—they want to wind up the month well on factory sales charts.

2. Dealing with dealers. The day of the "price pack"—when dealers arbitrarily added hundreds of dollars to the list price of a new car so they could offer a fat overallowance on your trade-in-is gone. But the price sticker that legally must be posted on new cars is not a firm figure. It is subject to discount. The dealer expects you to haggle. Remember that the cash difference between the new-car price quoted you and the allowance on your trade-in is all that counts.

How good a bargain can you get? That will depend on your ability as an oldfashioned horse trader.

The salesman's perfectly legitimate aim is to extract the maximum profit from you. Don't let him upgrade you past

your pocketbook. Don't take terms you don't want. Don't be rushed into a sale. If the agency doesn't have the car and equipment you want, wait. It can get them from another dealer or the factory. Remember, you have the last word: NO. The salesman will go to any reasonable lengths to avoid losing a sale.

3. Can you believe the ads? Mistrust offers to sell for "No Money Down" or for an exceptionally low down payment. High carrying charges on long monthly payments, typical of such deals, can cost you several hundred extra dollars.

Mistrust offers of fantastically high allowances for your trade-in. This device frequently is used as a come-on. A salesman offers you the high price on the trade-in. You close the sale. The salesman's boss balks. You are whipsawed back and forth between the two men until you agree to a lower figure.

Mistrust claims that the dealer is selling below cost. This never happens. The unscrupulous dealer will make his money on some kind of finagling, perhaps a fast shuffle on your monthly payments. If you agree to a \$5 increase on your payments, you are out \$180 on a 36-month contract. Many a car has been sold for less profit.

Mistrust offers of new cars for eyepopping low sums. The price may not include the freight charge. The car will be the lowest-priced two-door sedan in



the line. It may have accessories and special trim at added cost. You probably will be pressured into upgrading your purchase or buying optional equipment.

4. Makes and models. The compacts introduced a year ago have added a new factor to the U.S. price structure. So have the small imports. The smaller cars cost less and are cheaper to operate. The question for you is whether these cars have the space, performance, and riding characteristics you want. If they do, you save money.

In standard-size U.S. cars, a good rule of thumb is that resale value will be proportional to the car's popularity when new. Ford, Chevrolet, and Plymouth have long been resale leaders; Rambler and several of the compacts are now on the list. Plain-Jane cars depreciate faster than the classier models of the same make.

U.S. six-cylinder cars average about \$120 cheaper than eights of the same model. Furthermore, the sixes cost less to run and repair. Except for a few hixury models, sixes have a higher resale value in proportion to cost.

5. What accessories should you buy? Some accessories and pieces of optional equipment, besides being useful in themselves, are worth extra money at trade-in time.

Automatic transmission and power

steering are at the top of this list, Behind them come power brakes, air conditioning, radio, and heater. Money spent on most other extras is gone; you probably will get nothing back for power seats and windows, fancy upholstery, wheel covers, whitewall tires, extra lights, mirrors, and tinted glass. If a car is loaded with these options, ask for another model.

6. The ins and outs of financing. Financing a car costs you extra money. On a \$2,400 deal, if you put down only \$400 and stretch out payments to 36 months at \$66 a month, the interest adds up to \$376. Putting down \$1,000 and paying off in 18 months at \$85 a month costs you only \$130—a saving of \$246. Obviously it's wise to make as large a downpayment as you can and pay up quickly.

Be sure to read the financial terms before you sign the contract. A few unscrupulous dealers sometimes raise the price of the car on the contract; if you sign, you're stuck for the extra money.

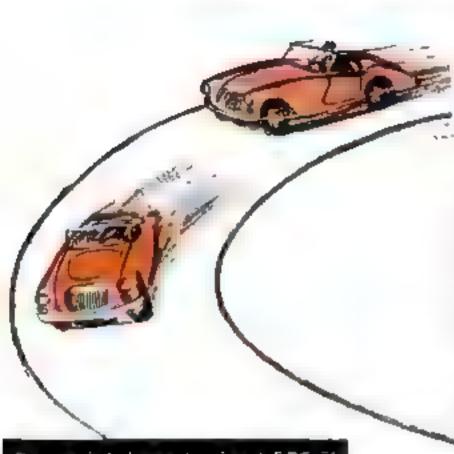
Watch out for suspiciously low monthly payments; the last payment may be a several-hundred-dollar whopper.

To sum up, know what you want and stick to it when you approach a dealer Don't expect miracles. Offers that sound too good to be true usually are.

Most important of all, shop around to

find the best deal.

### How to Test-Drive



Test-Driving

Check List

KEEPING SCORE as you test-drive makes detailed comparison easy. Just mark each item you or no.

THE man who wouldn't think of buying a \$60 suit without trying it on
often shells out 50 times as much for a
car he's never driven. According to experienced car salesmen, only one customer in five takes a demonstration
drive before he closes the deal.

Chances are your new car will be your daily companion for at least two or three years. What, most of all, are you looking for? Do you insist on scalded-cat acceleration? Or a smooth ride that would put a magic carpet to shame? Only a demonstration can tell you whether a car is right for you.

In today's competitive market, most salesmen are willing, and even anxious, to give prospects a test drive. A dealer

# BODY Easy to enter and leave? Seat height right? Pedals convenient? Steering wheel properly located? Instruments easily read? Windshield distortion? Front or rear blind spots? Wiper coverage good? Controls easy to reach? Excessive wind noise? Trunk easy to load?

	CAR	CAR	CAR
Cold-engine buck?			
Engine stall?			
Idle smooth?			
Engine noisy?			
Vibration at any speed?			
Acceleration satisfactory at all speeds?			
Engine knock under load?			
Quick warm-up?			
Overheating in traffic?		!	
MANUAL	_		
TRANSMISSION Lever easy to reach!			
Shift smooth and positive?			
Gear ratios well spaced?			
Clutch chatter in first or reverse?			

ENGINE

Start easily when cold?

Start easily when hot?

### a New Car By Bill Taylor

may even lend you a car overnight or for a weekend.

To get the most out of your demonstration, drive the car on a road that you frequently travel. Compare its ride, handling, and performance with your own car's. An unfamiliar road gives no standard of comparison. Besides—if you have to devote your attention to "reading" the road, you can't concentrate on putting the car through its paces.

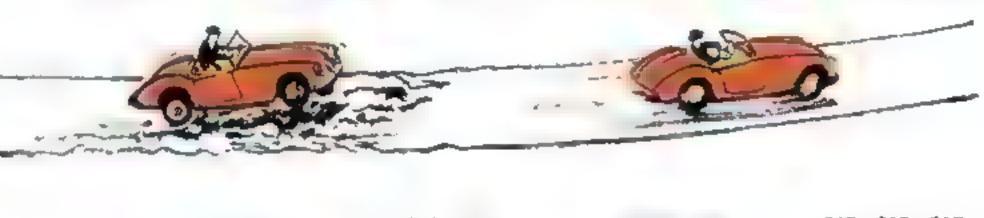
Whenever possible, take your demonstration in the same model that you plan to buy. Station wagons often are noisier and harder-riding than sedans of the same make. Convertibles don't have the visibility of hardtops. Windows are more likely to bind on hardtops than on

sedans. (Roll them up and down, to see.)

A test ride also is helpful in deciding between two options. If you're uncertain whether you want the economy engine or the power-pack, try both over the same route.

Try to differentiate between inherent design weaknesses and a car's individual defects of assembly. If the transmission doesn't shift smoothly, try another car with the same transmission before condemning the make. If the car rolls on turns or steers sluggishly, check tire pressure and try it again.

The accompanying road-test questionnaire can help you evaluate the new cars as you drive them. Snip it out and take it with you on your next demonstration.



TRANSMISSION	CAR	CAR B	CAR C	RIDE AND	CAR	CAR.	CAR
Smooth initial engagement?				Pitch or wallow on uneven road surface?			
Smooth automatic shifts?				Quick recovery after series of bumps?			
Unexpected down-shifts?  Kickdown available	_			Bottom on rough roads?			
when needed?			-	Excessive roll on turns?  Rear-axle hop on			
Ratios well spaced?			-	washboard pavement? Creaking or body rattles on			
Engine braking effective?				rough or uneven road?	Į .		
STEERING				MAKES			
Steering hard?				Brakes grab or pull?			
Too much wheel winding? Good wheel-return after		-		Pedal effort high?	_		
Car maintains course			$\vdash$	Brakes squeal or chatter?			
without frequent correction?		-		Brakes grab when damp?	-		
Road shock transmitted through steering wheel?				Brakes overheat or fade after frequent use?			
Power assist cuts in and out noticeably?				Parking brake easy to apply and release?			
Power-steering squeal or chatter on sharp turns?				Parking brake hold on hills?			<u>L</u>

### 850 Miles in Buick's New Compact

### By Devon Francis

NE morning early last July I slipped behind the wheel of a 1961 Buick Special in Buick's home town of Flint, and headed for the wilds of Michigan.

This was a new little Buick, and quite literally "little." It was a couple of feet shorter than a standard Ford, Chevrolet,

or Plymouth, and only eight inches longer than a Corvair. It was, in fact the littlest Buick in 30 years.

I was in for some

surprises.

The car was still a secret, not to be unveiled to the public until October. Yet it

was not camouflaged. It was a regular production car, Number 7 off the pilot line. Chrome lettering advertised Buick and Special saucily at the front and at the back

The Buick tycoons were depending on confusion over a flood of new "compacta" to thwart premature publicity. Their only fear was that someone might photograph the car for the newspapers three months early.

In the next 2½ days I would drive the new Buick Special 850 miles. I would find out what its tidy, new, aluminum V-8 engine would deliver on a gallon of gas. Frankly, I had tongue in cheek. This was no engine in miniature. It measured out at 215 cubic inches and packed 150 horsepower.

Beside me as a traveling companion was a man-mountain named Charlie Wurtz, one of Buick's quality-control experts. He stood six-feet-three in his socks, weighed 250 pounds, could pack away enough food to feed a combat platoon, and proved to be one of the smartest guys about cars that I've ever known—a

sort of Gus Wilson in a business suit.

Wurtz was along for a reason: If anything went wrong with this vehicle, he would have to fix it. We couldn't take it to the nearest Buick garage. The new Buicks were as much a secret from Buick dealers as from the public.

The car already had 590.4 miles on it. It had Buick's new, simplified Dynaflow transmission and—this annoyed me.

to see a neat little car gadgeted up so soon —power steering.

The start. We topped off the fuel tank with regular gas, as the manual advised.

"It's all yours," announced the amiable Mr. Wurtz.

I pulled the selector lever into Drive and stepped on the accelerator. That was my first surprise. For a compact, here was something fresh. We shot forward. I would have to learn to ease the pressure from my right toe. The transmission slipped quietly into high.

Leaving Flint, we encountered bumpy railroad crossings.

"Hit 'em hard," said Wurtz.

I did. The suspension planed down the bumps. The ride was superb.

On the open road I jockeyed back and forth between 45 and 55 miles an hour for a good break-in. We were headed southwest so we would encounter stop-and-go driving through the interminable small towns between Flint and Benton Harbor, over on Lake Michigan.

The car was built low. Yet Buick had managed an astonishing amount of room inside. Once I glanced at Wurtz' head, calculating his clearance under the roof. It was a good 2½ inches. With my five-feet-seven, I could have worn a silk topper.

Wurtz' long legs had abundant room



Smallest Buick in 30 years. It drew curious stares from other cars



Charlie Wurtz'
six-feet-three
looms over Special
on the far side.
But folding himself
in was easy

behind the firewall. And that tar-andtarnation dogleg windshield post finally, finally was gone. I could even forgive Buick for resurrecting its portholes.

"She hiccups a little at light throttle between 40 and 50," I remarked at dinner that night.

The second of the pot's two jets was cutting in somewhere in that range.

"I know it," said Wurtz. He rubbed a forefinger down each side of his mouth. "It's one of two things. It's the float level—that's an easy production fix—or, with the jets leaned-out for economy, we're getting backtalk from the tightness of the engine and transmission."

He frowned. "We probably could mend it with a richer mixture during break-in Want to wait and see?"

We learned quickly that the power surging didn't occur at brisk throttle.

Trying the curves. The next day we cruised north, stepping up our road speeds. The needle hovered between 55 and 60. The Special rode like a dream. I tried curves at 60 that were posted for 40. The rear end clung to the pavement.

On our first refill, at Holland, we topped off at 11.5 gallons. Wandering around a bit, sightseeing, we had come 215 miles, averaging 18.7 m.p.g.

"We'll do better," predicted Charlie

Wurtz, "She's still tight."

The pump jockey at the station eyed the car curiously.

"Check your oil?" he asked with feigned innocence.

"Oil's okay," replied Wurtz, pokerfaced. He had anticipated efforts to get a look under the hood by examining the dip stick in private a few miles back.

Returning from lunch in

Ludington, we found three men around the car.

"Hi," said Wurtz, the soul of geniality.
"This a new Buick?" asked one man.

"It's sort of a special job," said Wurtz, adhering strictly to the truth. "We're testing it." Our three visitors started to move off, "What's your rush?" asked Wurtz.

I was dumfounded when he raised the hood and began describing the engine in double-talk. Four or five minutes went by.

"Well," said Wurtz finally, "nice to see you."

He latched the hood. We climbed aboard.

"That ought to overdevelop his Polaroid picture sufficiently," commented
Wurtz blandly as we moved off. His eye
had caught what mine hadn't—as we approached the car, one of the three men
had torn the paper tab off a freshly exposed Polaroid shot. Throughout the
conversation he had hidden the camera
behind his back.

Special secret. A man and his teen-age son halted beside the car while we parked for a coke in Manistee. The man shook his head and glanced questioningly at the youngster.

"It's a 1961 Buick Special, Pop," said the boy, adding with a malevolent grin at us, "It's secret."

Twice we drew good-sized crowds, but we spotted nary a

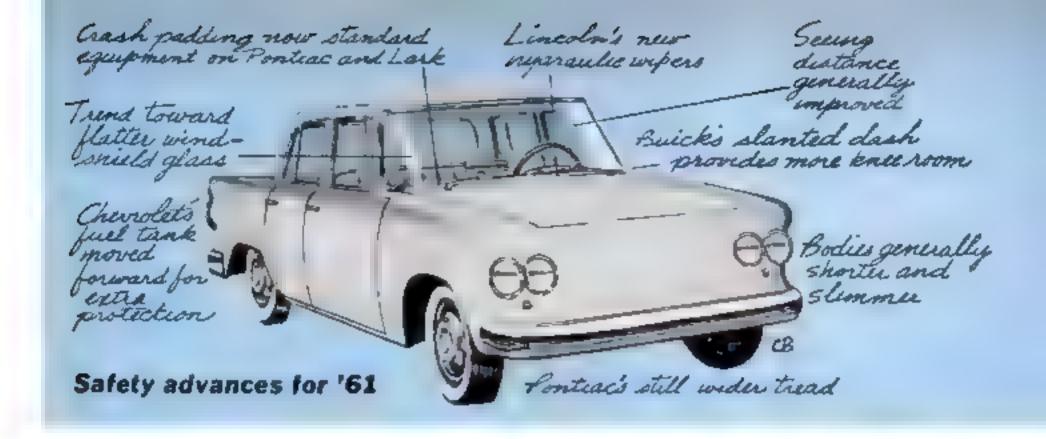
Near Traverse City, in Michigan's famous cherry country, we took 10 gallons of gas aboard. Our m.p.g. had been 21.7.

On our second night out, at the Straits of Mackinac sepa-

[Continued on page 235]

A Buick? Yep.





### A Safety Expert

By Paul W. Kearney Noted authority on highway safety

TN THIS year of bigger small cars and smaller big cars, Detroit has moved a little—just a little—toward greater safety. There are gains, even though one momentous advance is in litter disposal rather than safety. Windshields are coming back closer to the right front passenger-which is bad news for the wives and girl friends who so often fill that role.

Virtually no change has been made in the widespread but stupid arrangement of window cranks and door levers that can fracture a kneecap in just a hard stop. Not content with this, several lines have added tissue dispensers, record players, and air-conditioning gadgetry in places around the front cockpit where

they can bring painful injury.

That notorious fox trap, the one that pins rear passengers' feet securely under the front seat, is still with us. In this detail Chrysler Corp. products have improved over last year; Ford offerings are generally worse; GM's fair to very good. (Indeed, the Olds F-85 is better in this respect than some of its big brothers.) Universally lacking is any trace of crash padding along the upper edge of the front-seat back. Evidently not many engineers ride in back.

The credit side. Probably the most obvious improvement for 1961 is a general taming-down of the juke-box influence on instrument panels. There is less

needless brightwork—and an attendant reduction in eye strain.

Another welcome advance is a sobering of windshield design. Excessive bulge and wraparound seem to be giving way to flatter glass. This should improve visibility in driving snow or rain, even though most windshields are still much

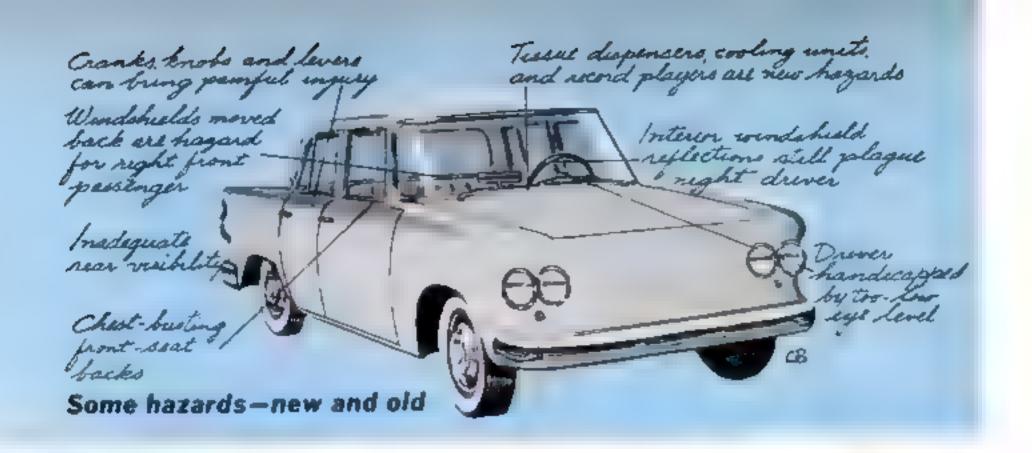
too big for their wipers.

The industry as a whole is entitled to recognition for its belated reversal of the mania for longer and wider cars. This year most standard models are 6 to 16 inches shorter overall. Even more important, most models are also narrower in outside dimensions without sacrifice of interior room. Last year no less than nine cars arrogantly exceeded 80 inches in width. Traffic engineers have been seriously concerned because cars need more elbow room as speeds increase.

Still with us, however, is the low silhouette. Highway engineers say that grades, guard rails, and other road-design features are based on the assumption that the driver's eye level will be 54 inches from the ground. Today the average is 48 inches, with many cars fixing it much lower.

In contrast to these complaints, we cheerfully offer some 1961 Oscars to:

 Pontiac and Lark for making crash padding standard equipment. This we've advocated ever since the padded dash came into being, but so far it has been limited, as standard equipment, to Lincoln, Imperial, and Cadillac.



### Rates the 1961 Cars

 Imperial for adding crash padding to the lower edge of the dash—a feature pioneered by Lark, incidentally—and to Pontiac for cushioning the entire instrument panel straight across with an im-

pact-absorbing pad.

• Lincoln Continental for its outstanding windshield clearing system (described later); its ingenious compromise between the bucket and the bench seat; and its novel automatic vacuum doorlocking system. This secures all doors as soon as the engine is pulling the car at something over three m.p.h.

 Chevrolet for repositioning the gas tank to provide it with greater structural

protection in rear-end collisions.

 Rambler for its ceramic-coated exhaust system with its promise of greater security against leaking fumes.

We should also give a nod to Mercury for its new "cushion-link" suspension, plus the car's total freedom from wind and engine noise—definite fatigue-reducing factors.

In contrast, Mercury's preoccupation with a vacuum litter-disposal system is depressing. Half of the brain power devoted to this innovation could have relocated that wretched window crank for

greater knee protection.

Bucket seat vs. sofa. Lincoln Continental's new seat design, on the other hand, appears to be a step forward. In a trial ride, it is immediately apparent that the portion of the cushion supporting the hips is much softer than the firm front

edge just behind the knees. This gives an approximation of the bucket-seat feeling in a conventional-looking bench seat. I found little tendency to slide on the seat while cornering.

This looks like progress in a realm that has seen little of it so far. Conceding the problems involved in satisfying a variety of heights, weights, and builds, Detroit still seems to cherish the overstuffed sofa as the proper automobile seat.

Another 1961 car I tried out with interest was the Pontiac Tempest with its four-cylinder, high-output engine; its transaxle, four-wheel independent suspension, and flexible drive shaft. I thought the car gave an admirable account of itself. The "four-banger" seemed surprisingly smooth and responsive; but the transaxle and flexible drive shaft will make no difference in handling that the average motorist will ever notice.

The roll-over danger. As has been repeatedly emphasized in these columns, roll-overs account for some 24 percent of nonpedestrian fatalities. It is reassuring, therefore, to find Dodge engineers so enthusiastic about their new Lancer's structural strength. They report that it took seven successive roll-overs to cause any measurable weakening of supporting members.

Also heartening to hear is Pontiac's opinion that their wide-track arrangement has been successful in preventing

### What's Coming in the



### Saab

Better performance, a roomier interior, and slicker styling are major changes in the 1961 Saab. Rear window area is increased 117 percent. A bigger luggage compartment and more efficient heating and ventilation are added features of this Swedish front-wheel-drive ear. Its price should remain about the same.

BIGGER, faster, better-styled, more luxurious—these are adjectives for next year's crop of foreign cars. Here's what the imports may be offering you for the year 1961.

Volkmagen. Rumors of a new, larger car that will supplement the current top-selling VW crop up persistently. Such a model, if introduced, probably won't ap-

pear for several months yet.

Unlike American cars, VWs don't change much from year to year. Small improvements, however, are sneaked in every few months without fanfare. The 1945 model and the current model look amazingly alike, but performance, handling, comfort, and durability are miles apart. Some newly available changes are: the Transporter engine (40 hp. as compared with 36 on the current pas-

Volvo P 1800

With styling reminiscent of the Ferrari California, and a 1,780-cc. engine that should be capable of 120 m.p.h., the P1800 promises to be a good seller. Cost will be about \$3,800.

senger-car power plant), transmission with all four forward gears synchronized, a manifold preheating device, windshield washer, second sun visor, automatic choke, flexible grab handle, colored steering wheel and running boards, a new gas tank to increase luggage space.

Improved windshield-wiper rubber and a standard-equipment side-view mirror are possible future additions. An improved heater may also be provided for the comfort-sensitive U. S. market.

Renault. Like VW, Renault doesn't retool annually. Some recent modifications that are just appearing on current models are: rear-door safety locks, improved suspension, increased front-seat travel, nylon door catches.

The popularity of automatic transmissions in the U. S. may bring about an automatic clutch such as the Saxomat for export models; the Renault engine is too small to handle a true automatic box.

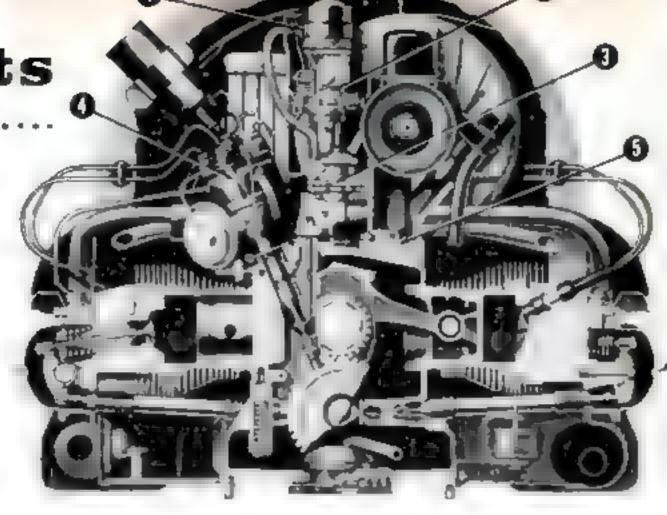
The Caravelle, Renault's equivalent of the VW Karmann-Ghia, has proved popular in spite of its \$900-higher price tag. It was introduced cautiously at the end of 1959, and supply has lagged far behind demand throughout 1960. Increased production should brighten the situation for this car.

English Ford. There'll be some changes made. The talk inside FoMoCo is that the Prefect may be replaced completely—by a hardtop sports car. Best guess is that it won't appear until early next year. Price: about \$1,800. Anglia, top seller in

Imports

### Volkswagen

New VW engine squeezes four extra horses from increased compression, different valves and cam. Other modifications are: 1) Air cleaner with preheating to eliminate carb icing; 2) automatic-choke carb; 3) new fuel pump; 4) vacuum-controlled spark advance; 5) detachable generator support.



the line, was redesigned completely for 1960, and should remain virtually unchanged for next year

The Escort probably will be completely retooled; the flathead engine that the Escort shares with the commercial van line will be replaced by an OHV mill.

A retooled Consul—perhaps named the Mark III—is a good bet. Its highly successful engine should remain basically unchanged, but its 61 hp. may be mildly increased.

Volvo. The new P1800 sport coupe will be available here at the end of 1960 or in early 1961. A 100-hp, machine with a new engine and body, it should be a quick one.

Citroen. By January, either the ID-19 or DS-19 will come out in convertible form.

A VW-sized Citroen, somewhat similar to the ugly-duckling 2CV that never caught on in the U.S. market, should appear within a year. Engine of the new car (possibly called the 3CV) will be slightly more powerful than that of the

2CV. Styling will be considerably more pleasing than the queer-looking 2CV's. It should sell in the \$1,600-1,700 price range, to catch some of the VW-Renault market.

Sanb. A new five-passenger car will make its debut next year. The current engine will be hogged out to 842 cc. and horsepower will rise from 38 to 42. Other features: wraparound rear window and reworked dash.

The new Saab station wagon, highly successful in Europe, will hit the U.S. market around October or November.

The Saab GT probably will have a new, stylish body and a 62-hp. engine.

Taunus. A small front-wheel drive car that has been circling FoMoCo's test tracks lately may be the new 1961 Taunus.

Peugeot. The new, larger 404, now marketed in France, will be introduced April 1 at the New York Auto Show. It will supplement the present 403 model.

Borgward. An optional four-speed, semiautomatic transmission should be

[Continued on page 250]

### Borgward

Powered by a 2,240-cc. OHV six, the Big Six will sell for about \$3,995. All forward gears are synchromesh. At 70 m.p.h., fuel consumption measures about 25 m.p.g.





BANANA HAULER can skim over jungle trails and streams at 12-inch altitude. Estimated top

speed: 40 m.p.h. It will carry three men plus cargo, making a total load of about one ton.

### Banana truck rides on bubble of air

Hauling bananas in the Southern Cameroons is a problem: bad roads, unreliable rivers, and a cargo that bruises easily. So Elders and Fyffes, Ltd., who own plantations there, ordered a truckwithout-wheels to float their fruit out of the jungle on a bubble of air.

The first model (above) gets its air bubble in a way that may lead to cheaper, more effective wheel-less vehicles. Instead of a central fan blowing air through costly ducts to the edge of the body, it

has fan blades at the edge to push air straight down, as shown in the drawing on the facing page. The fan has no hubjust two concentric rings connected by blades. The rings, riding on rollers, are spun by a friction drive. The outer ring is so large (about 18 feet in diameter) that its edge spins at 240 m.p.h.

The same engine that spins the fan also powers two propellers to scoot the Cushioncraft forward. Britten-Norman,

Ltd., of Britain, built it.



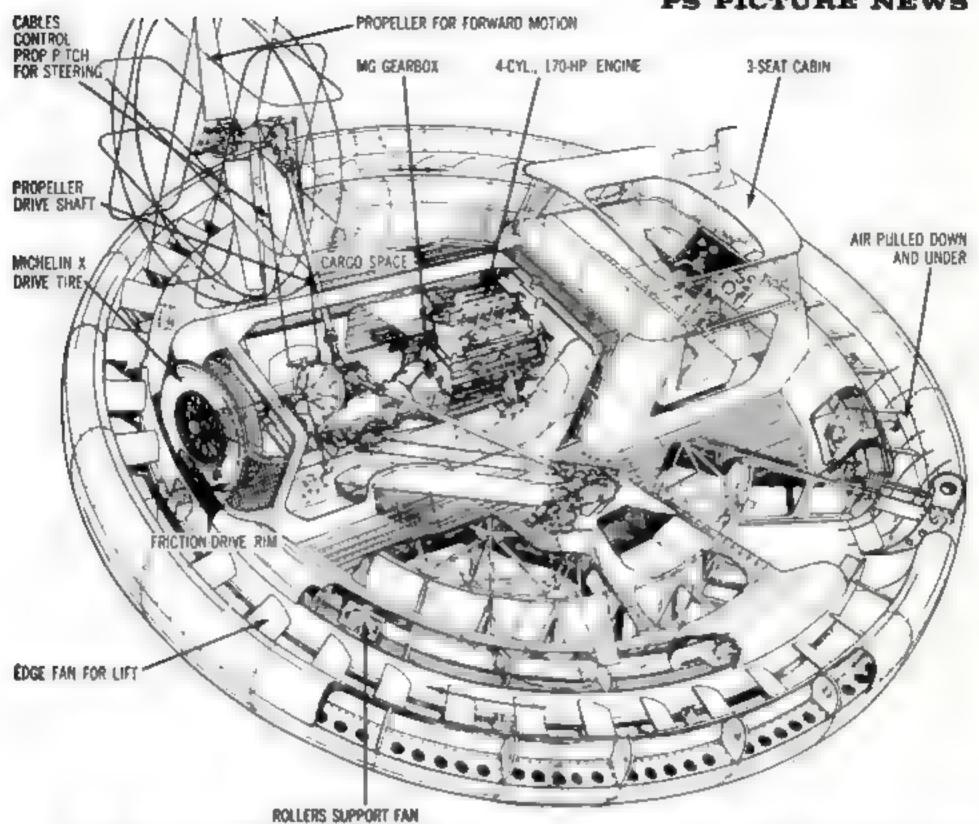
### Solar generator to circle earth

A 1,500-watt solar generator will furnish power for space satellites by converting energy from the sun into

electricity.

It will contain about 7,000 four-inch aluminum reflectors like those in the sixbank test model at left. They will concentrate sunlight on collectors in their centers, producing heat of 1,000 degrees at the hot end of a thermocouple. Hamilton Standard is building it for the Air Force, For ground-test-ing, a 100-watt, 900-reflector model will be made first.

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TRICKY DRIVE SYSTEM is shown in cutaway from British journal, The Aeroplane. Car wheel, spun by a sports-car engine, presses against rim of the fan to turn it. The fan rides on rollers.



ODD LANDING GEAR on the Canadian Otter was devised to simulate a tricycle gear cheaply.

### Four-wheel landing gear

Canada'a de Havilland Otter, already noted for short takeoffs and landings, has become even more STOL after a four-year guinea-pig stint. As shown above, it has been fitted with big and



FLAPS DOWN, the Otter makes a low-level flight over an airfield at a slow 42 m.p.h.

powerful wing flaps and a new tail that rides high. The angled horizontal "butterfly" tail surfaces allow the airplane to clear air swirls set up by the big flaps. The unusual landing gear -substitute for costly tricycle gear-gives good air flow over the tail for control on the ground. Along flyways as crowded as a Sunday turnpike, migrating birds travel up to 25,000 miles a year. Here's what we're now learning about—

### How Birds Find Their Way in the Sky

### By Wesley S. Griswold

EN peering through field telescopes at the bright face of October's full moon have occasionally caught glimpses of an eternal marvel not more than 3,000 feet above their heads. That shining disk has spotlighted for them a small portion of the stupendous southward flights of birds that take place every year at this season.

Watchers have counted as many as 9,000 birds an hour streaming past the moon. From that tiny illuminated sampling they have estimated that in the same hour hundreds of thousands of travelers were winging south.

Few of us ever see this spectacular show. That's because most of it takes place in the dark. Be they bluebird or bobolink, robin or wren, most migrant

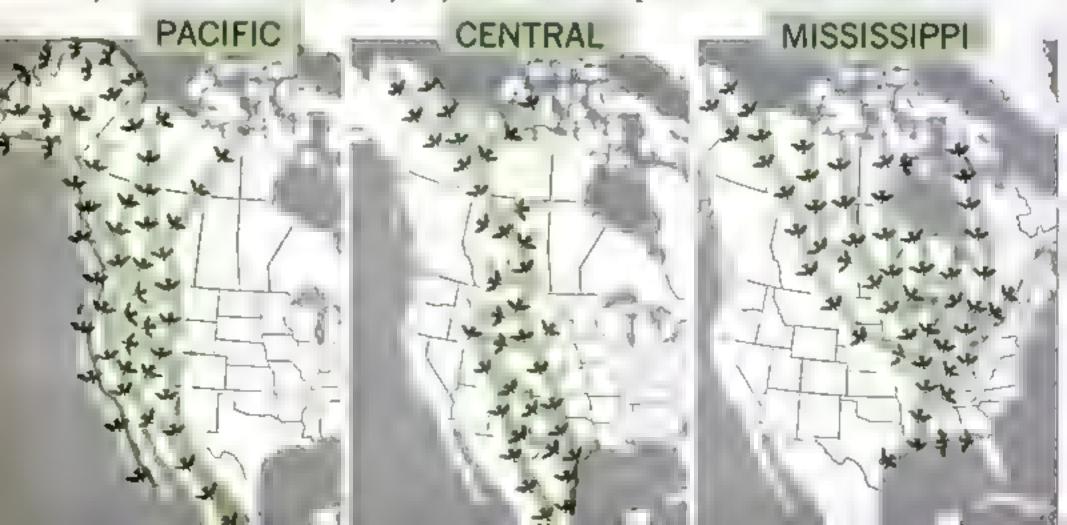
FLYWAYS, plotted by Frederick Lincoln of the U. S. Fish & Wildlife Service, are the sky highways birds use on their twice-a-year jaunts.

birds favor flying between eight p.m. and midnight, and between four and six in the morning.

Celestial navigation. How birds perform their twice-a-year feats of long-distance night flying has mystified men for ages. The explanation used to be that they have a "marvelous sense of direction." That is unquestionably true, but not specific enough to suit scientists. Besides, radar has demonstrated that when birds run into heavy clouds or fog, they can lose their sense of direction and mill about in confusion.

But now a 35-year-old German scientist from the University of Freiburg thinks he has the answer. After careful study of European warblers, Dr. E. G. F. Sauer puts forward the astonishing theory that these birds navigate by the stars. He concludes that they (and other

Heaviest travel in the Western Hemisphere is along the Mississippi Flyway, popular with birds who push on to the Gulf of Mexico and



night flyers) are born with an instinctive knowledge of a map of the stars, plus the ability to relate it precisely to the season and to where they are on earth.

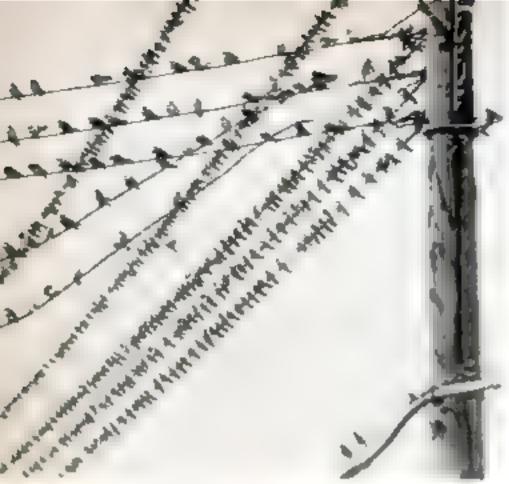
Birds can navigate by the sun, too. During the past 10 years, English and German scientists have proved that homing pigeons and starlings relate the sun's slowly changing position in the sky to the direction where they want to go. Daytime migrants can plot their course this way, as can night birds, resting or foraging for food.

"Flyways." While European scientists explore birds' navigation gear, an American has already answered another navigation question: Do birds flock to a few major routes once they know where they're going?-Are there highways in the sky? Yes, says Frederick C. Lincoln of the U.S. Fish & Wildlife Service. In 1935, after long study of banding data, he identified four major "flyways" for birds CONTINUED

points south. The Canadian ducks and geese in photo at right pick the Pacific route.







sattations of tree swattows form up along telegraph wires on route to winter quarters specialists now think that the birds, daytime flyers, plot their course by the sun



IT DOESN'T HURT A BIT: A Canada goose sits patiently while its leg band is fastened. Key data on species, date, and place of banding are coded on the identification anklet

in this hemisphere, He named them the Atlantic (coastal), Mississippi, Central (eastern slope of the Rockies), and Pacific (coastal) Flyways.

Traffic is heaviest on the Mississippi flyway. Many of its millions of travelers, including the tiny ruby-throated hummingbird, push on across the Gulf of Mexico to Central America and beyond.

Other distance travelers include the barn swallow, who winters in Brazil; the bobolink, who hops from Florida to Cuba to Jamaica to Venezuela and parts south; and the Atlantic golden plover, who flies nonstop from Nova Scotia to northern South America, covering 2,400 miles in 48 hours (an average 50 m.p.h.!), and winds up way down in Argentina.

But the greatest long-distance flyer of them all is the Arctic tern. This bird breeds as far north as feasible, and then migrates almost to the bottom of the world for the winter. It covers at least 25,000 miles in its round trips.

What sets them moving? People used to think it was nippy weather that drove birds south. Experts now know that the reason is more complex. Some birds leave northern points as early as mid-July. Others hang around until there's snow on the ground. Chickadees never leave at all.

In general, those with the longest journeys make the earliest departures. But for the most part, the migration timetable depends on the food supply. As the days shorten, there are fewer hours in which to find edibles. As the temperature drops, summer insects begin to die off or hibernate. This, not chilliness, starts insect-eating birds on their way to tropical lands. The seed-eaters soon follow, though some wait until the first snowstorm buries their forage.

The chickadee is a stay-at-home because it feeds entirely in trees, where there's usually something to eat all year.

No "togetherness." Food is more important than sex at fall migration time. Few males and females travel together. Ducks are an exception. They take the whole family along, instinctively flying in V formation. With a wise old drake out in front, this makes it easier to keep tabs on everyone.

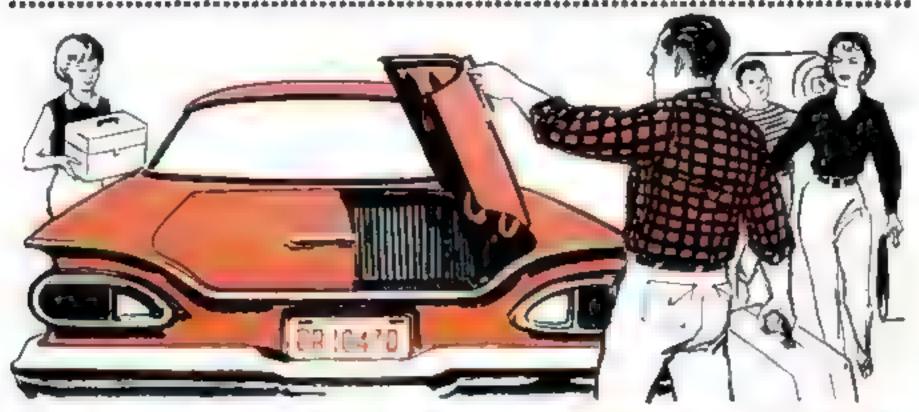
Parents of perching birds drive their youngsters from the nests as soon as they can fly. The small fry, smarting with resentment, get together and fly south by themselves, ahead of the old folks.

The frivolous female phalarope heads south as soon as she has laid her eggs. She leaves her mate to hatch them, take care of the young, and follow her whenever he can break away from his tedious domestic round.

Steady as they go. While the southward trek allows no dawdling, birds don't break any speed records, either. Most fly at the leisurely pace at which they hunt food. For the little birds we're most fa-

[Continued on page 224]

### "I'd like to see them make..."

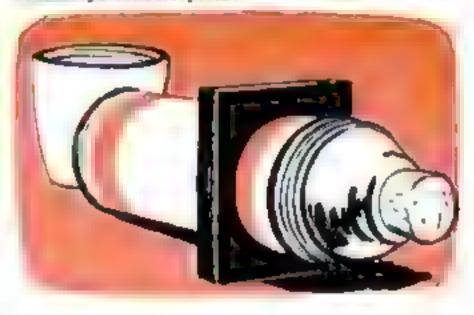


A SPLIT LID FOR CAR TRUNKS. If hinged at each side, the trunk would take bulker items or, with

a canvas enclosure, form a box bed.—Starr Moshier, Rochester, N.Y.



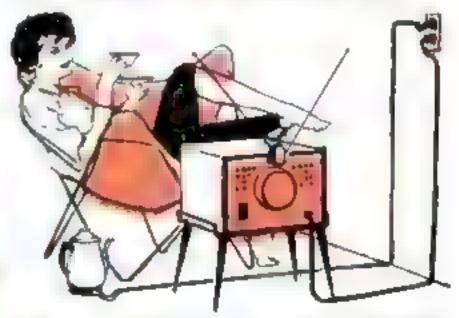
A POWER-DRIVEN VIBRATING BRUSH for removing old wallpaper that has been painted over or is otherwise stubbornly unaffected by soaking.—
Ralph T. Stewart, Winston-Salem, N.C.



THERMOS-BOTTLE GIRDLES of hard rubber. Shipped over a bottle, they'd add corners to keep it from rolling off a table or bench and smashing the hining.—F. M. Scott, Leonia, N.J.



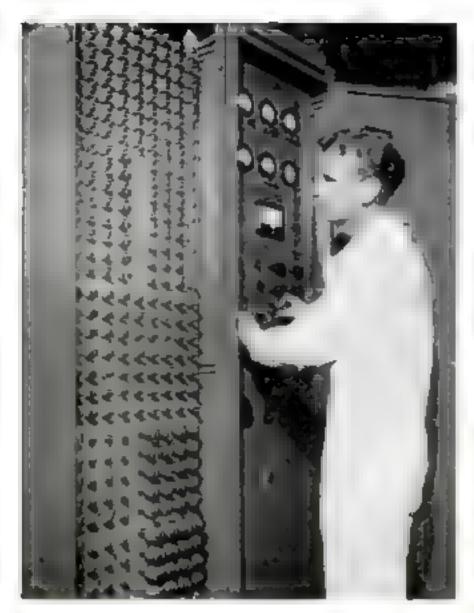
ORNAMENTAL SHUTTER LATCHES of black plastic instead of wrought iron. They wouldn't rust and streak stains over the siding as metal ones do.—J. E. Weber, Chevy Chase, Md.



FLAT APPLIANCE CORDS for outdoor equipment. With adhesive on one side, they'd stick to a wall or patio floor, be safer, and look neater.—Richard Hughes, Pompano Beach, Fla.

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by Popular Schwar readers. What's

yours? We will pay 45 for each one published. Please use Government postcards only. Write name and address clearly Contributions cannot be acknowledged of returned.



### Tubes aged in the glass

The 300 tubes in this bank are being put through operating conditions for 200 to 400 hours before going into use. Reason Boeing has discovered that most defects in tubes running its automated machines show up in the first 400 hours of operation. After aging, they are good for 5,000 to 10,000 hours.



### What's under the bridge

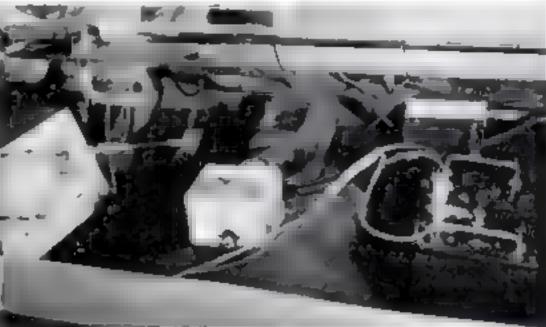
Pedestrians and bicyclists who use the lower level of a new bridge near Munich in West Germany get a view of the Mangfall Valley below through a huge elliptical cutout that divides its two lanes. Autos use the solid upper level The unusual bridge was completed in 20 months at a cost of more than \$1,500,000.

### Highway travel by tape recording

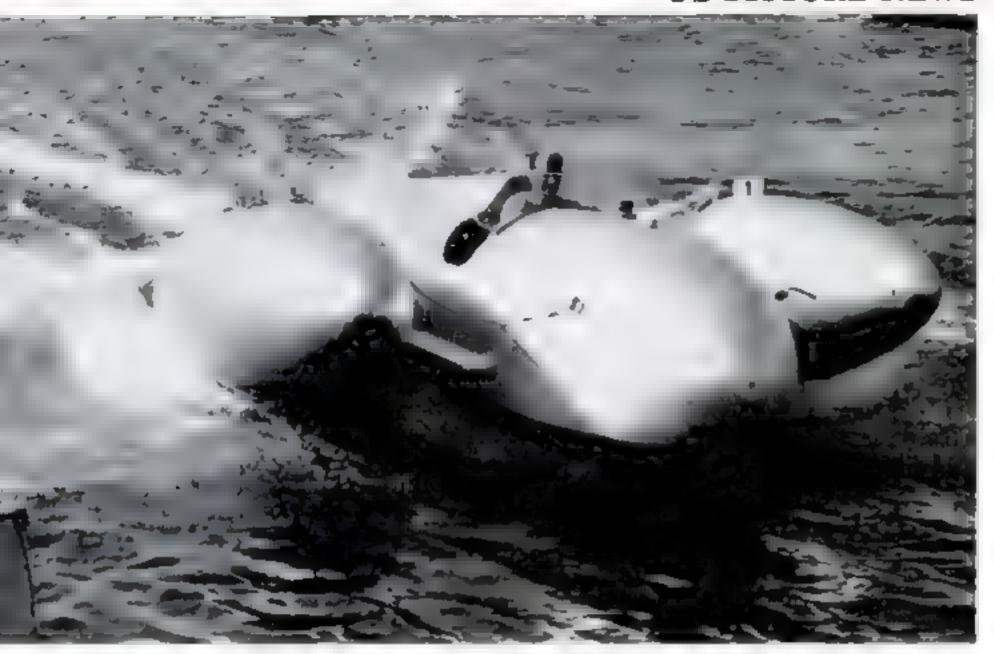
New experimental gasolines and lubricants are tested by tape recordings at the Socony Mobil labs at Paulsboro, N.J. The tapes are recorded during trips vary-



RECORDING INSTRUMENTS installed in a pilot car make a faithful reproduction on tape of acceleration, speeds, and grades on highways.



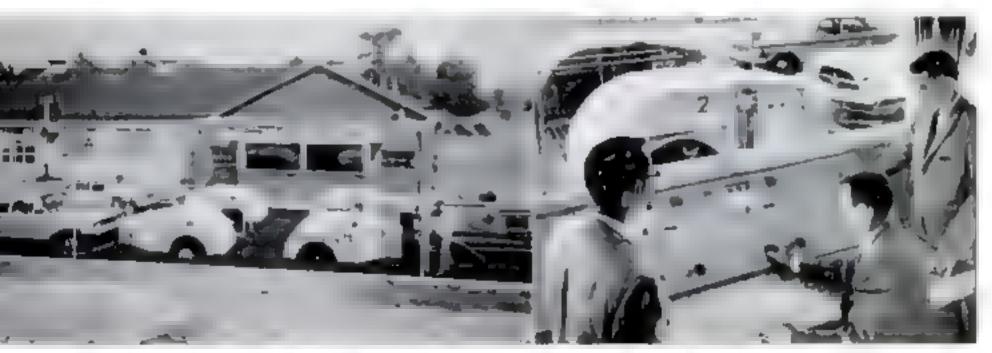
REPRODUCTION EQUIPMENT connected to test car's controls plays back tape to simulate traffic and highway conditions encountered in travel.



### Floating wing tanks ride the waves

This outrigger motorboat not only floats at makes a speedy 25 knots in a rough sea. It was built by Bill Wheeler of Coral Gables, Flat, entirely from junk: three wing tanks salvaged from U. S bombers. Wheeler cut an opening and put a sent and an old inboard motor in the largest, a 25-footer. Then he mounted two smaller ones on swivel bars for pontoons that ride up and down on the waves.

ing from bumper-to-bumper traffic to open-highway driving. On playback in robot-controlled cars mounted on treadmills, they simulate the exact acceleration and braking patterns that are used on actual runs. Such standardized testing enables researchers to analyze performance of new fuels and oils.



DRIVERLESS TEST CARS are mounted on treadmills. They travel hundreds of miles on taped controls without actually moving even an inch.

CONTROL PANEL in Socony Mobil lab lets one man put four cars through their paces in tests of experimental gasolines and lubricants.

## When Will We Start Start Burning Water?

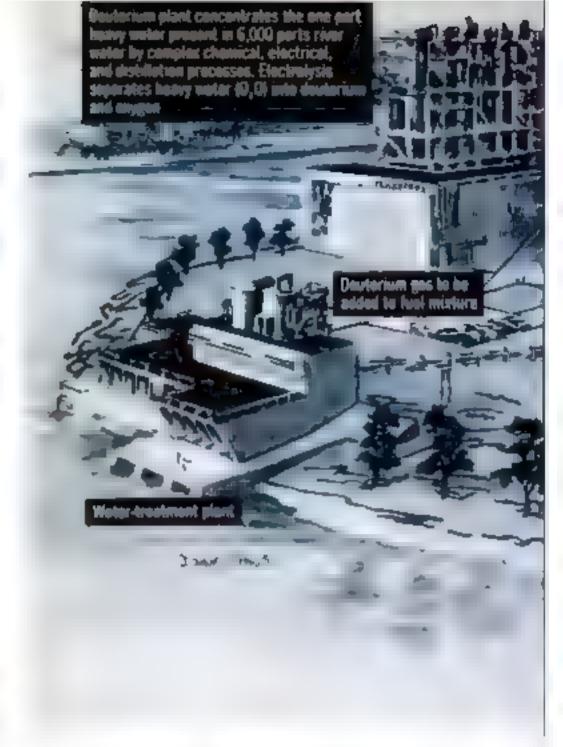
The hope: unlimited power.
The fuel: water. The date:
not tomorrow . . . but soon

### By Harland Manchester

BOUT 1,000 scientists and engineers in eight countries are now designing, building, and testing a variety of strange new machines in a race to solve one of the most inspiring and baffling riddles man has ever put his mind to—how to harness the fusion might of the hydrogen bomb and convert the killer into a docile engine that will produce

power unlimited from water.

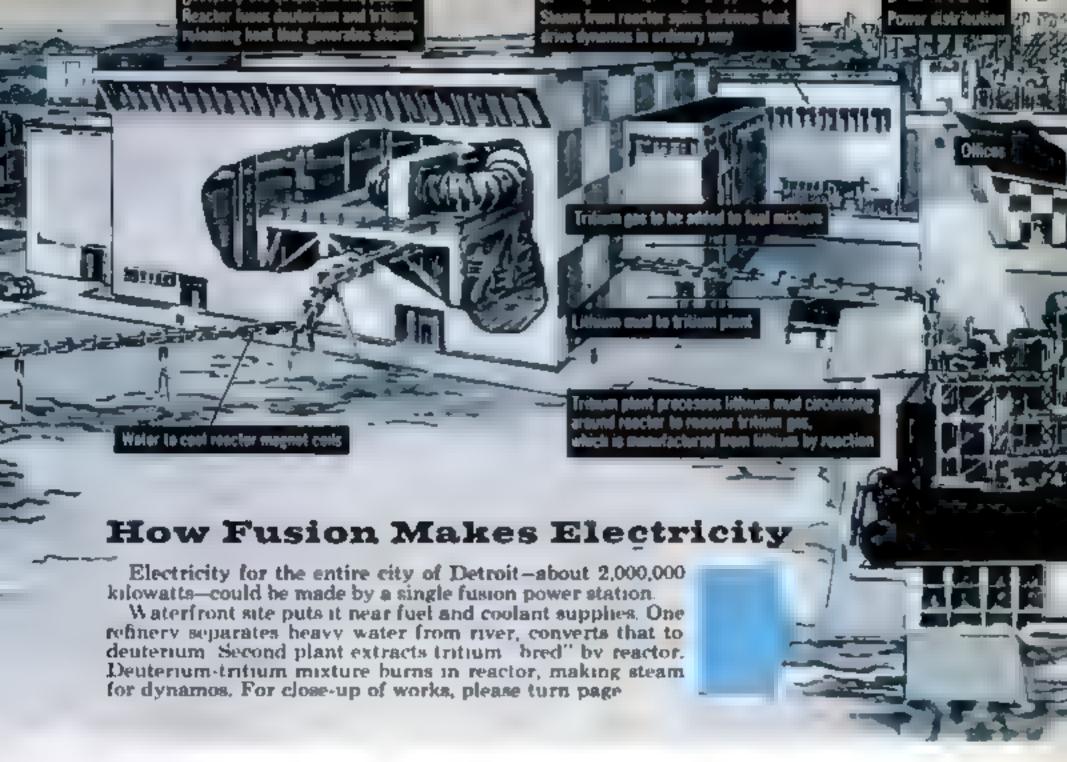
The basic facts behind this ambitious plan seem quite simple. All water contains a minute bit of "heavy water," compounded of an isotope of hydrogen that has an extra particle in its nucleus. These special atoms, as scarce as four-leaf clovers, constitute about 1/6,000 of water everywhere. Yet there are enough of them in a glass of ordinary water-if combined under certain conditions in a reactor-to supply energy sufficient to drive a car 400 miles or to provide electricity for an average American house for a month. If all the heavy water in the world's oceans, lakes, and streams were converted into power, it would equal the energy of about 17.500 billion billion gallons of gasoline, or supply all the world's needs for 10 billion years or so. This super-fuel, which looks like ordinary water and is only a little heavier, should be durt cheap if extracted in bulk.



A fusion reactor could not, of course, operate on heavy water in its watery form, any more than car engines run on petroleum, From heavy water it is easy to extract the actual fuel, the "heavy hydrogen" that is called deuterium. The deuterium would be "burned" in gaseous form in a fusion reactor to make electricity. In existing atomic plants operated by fission, the giant nuclei of uranium-235 atoms are smashed into small fragments, and some leftover matter is converted into energy. In a fusion plant two tiny deuterium atoms would be combined to make one atom of helium with a far greater conversion of unused mass into energy. This is no guesswork: The sun and millions of other stars have been doing it since time began, and life on earth is made possible by the great solar thermonuclear fusion plant.

Scaled down to earthly size, such a plant could heat steam to drive turbines, as do today's atomic plants; but scientists believe that fusion offers a much better chance of converting energy directly into electricity, eliminating the cumbersome

steam cycle.



Such a fusion reactor couldn't blow up or go into a "runaway reaction" as a fission plant can, since its fuel would be injected a little at a time instead of all at once. And, best of all, it would produce no radioactive "ash" to poison people, crops, and wild life. Present fission plants, by contrast, produce ashes that are very dangerous unless confined at great expense—one of the gravest problems of the infant atomic fission industry. In short, the whole prospect seems so alluring that the natural question is: What are we waiting for? After hearing this question a few times, one young physicist, who has bloodied his nose against some stubborn facts, made an ironic sign for his lab that read: "All You Have to Do Is-"

But the simplicity ends the moment you try to build such a reactor. Scientists began work on the problem about 10 years ago. The AEC has spent about 125 million dollars on the project, and plans to continue spending about 25 million dollars a year. U.S. firms and universities have spent additional sums, and the combined projects of Britain, Russia, Ger-

many, France, Sweden, Switzerland, and Japan are said to total twice the American effort. Some 40 experimental fusion devices of various sizes and design have been built and tested. Scientists have learned a lot about what can't be done and less about what can.

"Once it looked simple," said Dr. Richard F. Post, lean young fusion pioneer of the University of California Radiation Laboratory. "You heat a little deuterium gas in an evacuated chamber to 100,000,000 degrees or so, the reaction starts, you keep on feeding in more gas, and you have the source of power for all time. But we soon discovered that if anything can go wrong, it will." Every time one question is answered, more pop up.

One problem of the H-bomb tamers recalls the predicament of the young chemist who tried to invent a "universal solvent," then wondered what he would keep it in. If you heat deuterium hot enough for the atoms to fuse, no material container will hold it. Tungsten, for instance, the world's most heat-resistant metal, melts at 3,440 degrees Centigrade.

In the sun's nuclear fusion plant, the

force of gravity acts as the furnace wall. Since scientists can't build a sun-size reactor, they have adopted another invisible barrier—a magnetic field that cages the hot fuel and keeps it away from the metal reactor shell. In a sense, it does the job of the heat-resistant brick lining used to insulate furnace fireboxes. Already, temperatures of 10,000,000 degrees have been reported in such experimental reactors, and scientists hope that this intangible lining will provide the necessary container.

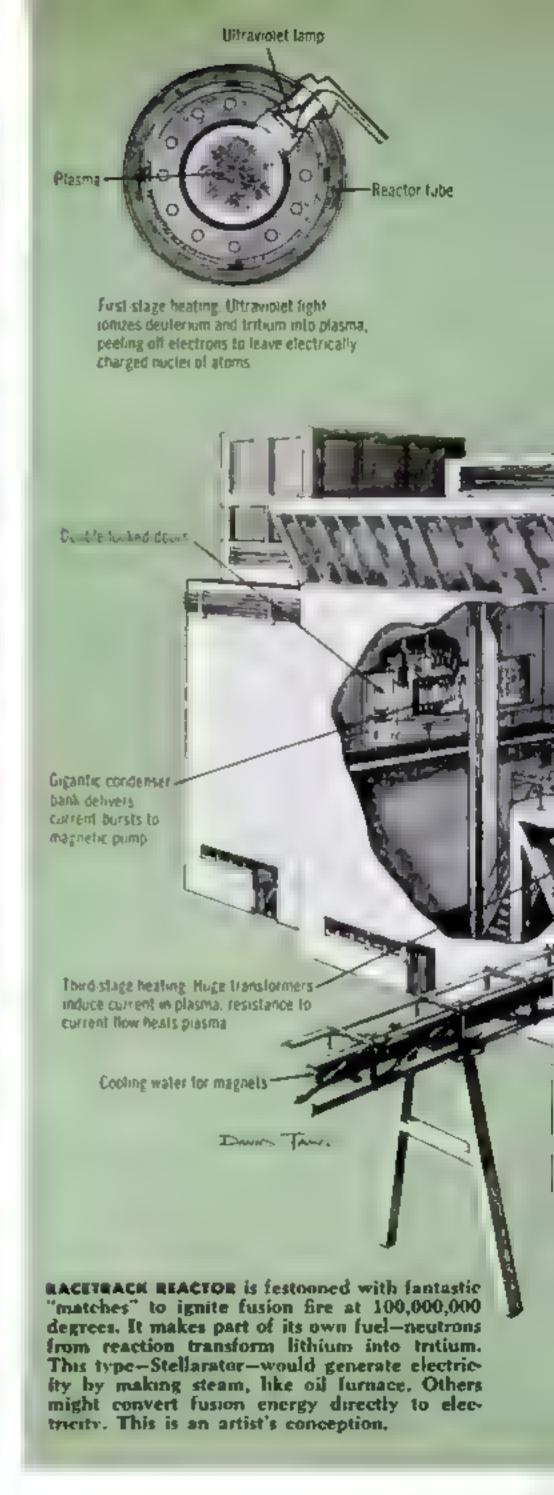
These magnetic bottles, or "cages," have been made in many designs in laboratories all over the world. But they are driving scientists crazy with their erratic behavior. Their walls have holes in them through which particles may escape. Said Dr. Edward Teller, sometimes referred to as senior statesman of thermonuclear fusion:

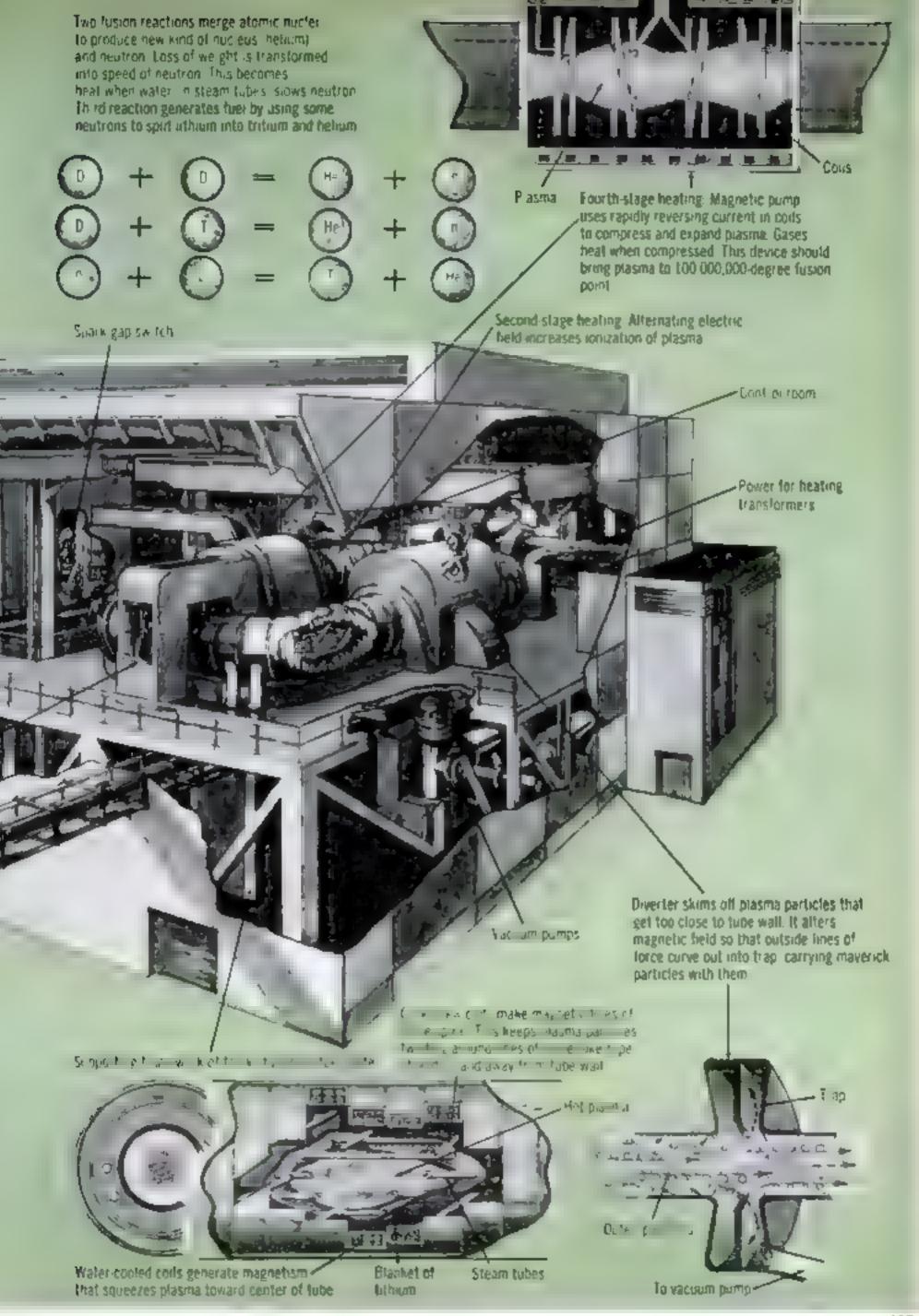
"It's as though the walls and ceilings of this room were lined with a layer of water held in place by pressure. If you disturb it, globules will break loose, and soon the lining will collapse."

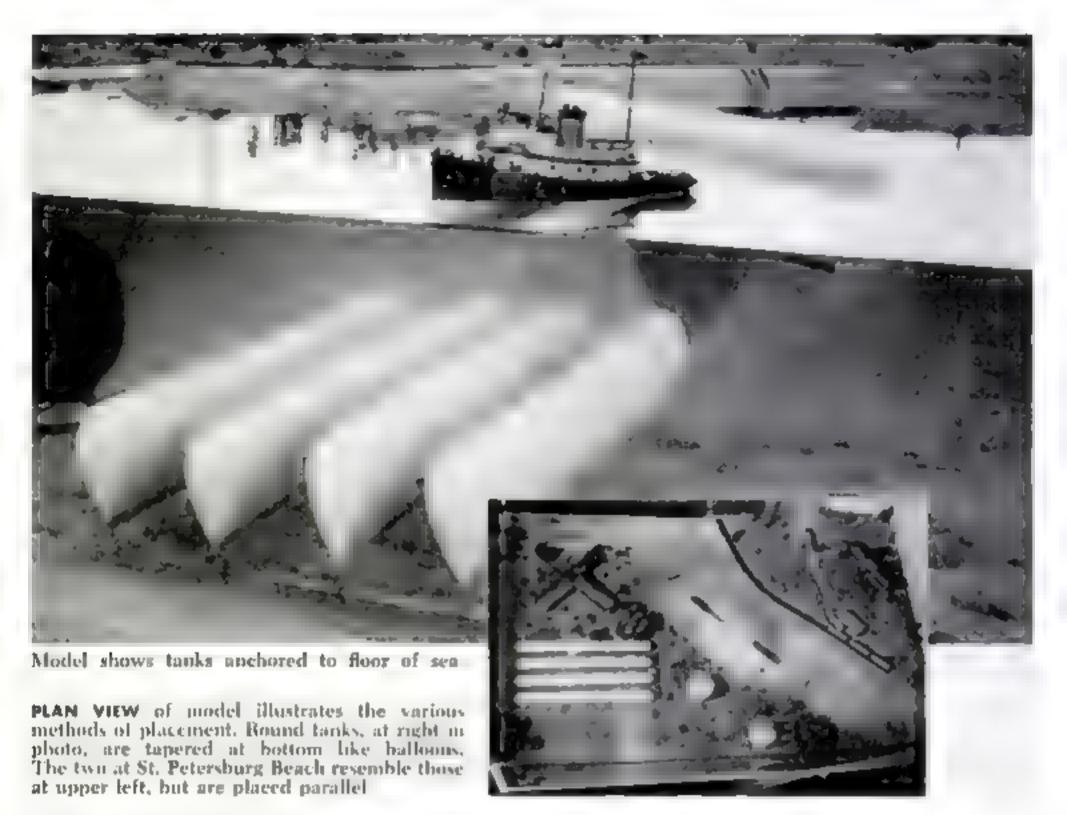
If this happens, the fuel will cool off, running the reaction. Or a small kink may develop in the magnetic cage. Like the wobble of a spinning top, it grows rapidly once it starts and the reaction stops. This has been a problem with all reactors, and a Russian physicist at the Geneva conference two years ago proposed a toast "to stability." Devices of many types have been built to prevent the wobble, and Dr. Teller reports that one machine in California has solved the problem.

There are many other headaches. In order to smash the deuterium atoms together hard enough to fuse them, you first have to peel off their outer shells of electrons to get bare nuclei; otherwise they cannot be forced close enough together to fuse. The actual fuel, therefore. is an ionized gas called a "plaama"—one of the key words of the whole campaign, About 99 percent of the universe is composed of such plasma—the sun, the stars, and much of space. It makes up the ionosphere. The conducting gases in neon and fluorescent lamps are plasmas, and they have been used for years in several electronic tubes. Many scientists are studying the whole nature of this fourth state of matter as an initial step to the

[Continued on page 240]







**SHORE TEST** of Firestone neoprene-nylon tank shows tapered shape and valve through which it is filled. The edge in foreground is fastened to channel steel anchored to the sea floor



### Storage tanks on the sea floor

Three huge rubber-and-fabric containers have been anchored to the floor of the Gulf of Mexico to store emergency supplies. Two of them, holding 10,000 gallons each, are 300 feet off St. Petersburg Beach, Fla. One contains fuel oil, the other fresh water for use in case hurricane or flood contaminates the city's usual supply.



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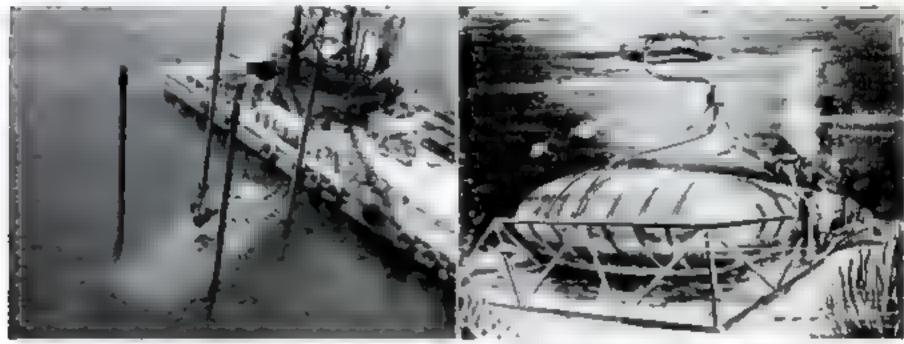
### Seeing-eye drawbridge

Fog-piercing radar now warns attendants on this Duluth, Minn., bridge of the approach of a ship in heavy weather before it can be seen. They then raise the bridge to let it pass. The radar is on the roof of the control room on the lift span. It was installed by Raytheon when opening of the St. Lawrence Seaway caused an influx of deep-sea vessels.



1. DEFLATED NAVY CONTAINER is shown strapped to frame on barge. Piles near corners will be driven through sleeves to anchor it.

2. SWUNG OUT OVER WATER, the still-deflated U. S. Rubber envelope is positioned by a giant crane before being lowered to sea bottom.



3. CONTAINER SINKS UNDER WAVES, followed by valve at center with connected flexible hose.

4. DRAWING SHOWS TANK anchored to bottom with swivel valve and fuel-transfer float above.

The third undersea tank, a 50,000-gal. whopper, is being tested by the Navy for refueling ships in the Bay Marchand oil fields off the Louisiana coast.

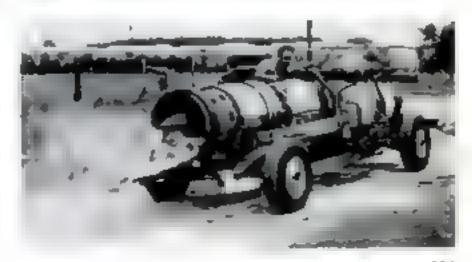
The Navy installation may lead eventually to underwater refueling stations at strategic spots over the world. The tank is a 22-by-70 foot U.S. Rubber envelope; when filled, it's six feet deep. Harnessed in a steel frame, the tank is lowered into the sea and anchored with 80-foot steel piles driven into the floor through sleeves in the frame. Filling and

discharging are through a six-inch flexible hose connected to a buoy on the surface. A pressure device on the buoy signals when the tank is full.

The St. Petersburg Beach storage tanks were made by Firestone for the Jet Fuel and Storage Co., of Washington, D. C. They are held to the bottom by one edge on swivel fasteners bolted to steel channels, called strongbacks. These are anchored to the Gulf floor. Filling or emptying of the tanks is accomplished through hoses running ashore.

#### Fire-breathing jetmobile

Like a dragon in reverse, this jet-powered car spits fire from its tail instead of its nostrils as it races in open fields in Hialeah, Fla. Bill Vandervalk, a salvage dealer, built it from Air Force scrap. He has never been bothered by tailgaters. The drum that looks like an engine hood in front holds diesel fuel. One test run can empty it.



#### PS PICTURE NEWS



EXTRA AIR swallowed by monster intake fans bypasses the main engines to give added thrust to new Stratoforts.

#### Bigger air bite for B-52

Oversize blades in the maws of its turbofan engines will gulp vast quantities of air to increase range and shorten takeoff for the B-52H bomber [PS, Sept. '59]. The new models will be delivered to the Strategic Air Command next year. Huge fan blades in front of the eight Pratt & Whitney jet engines act like propellers in a conventional plane to increase performance while lowering noise during the Stratofort's climb to altitude. The B-52H also will carry more punch: the Douglas Skybolt, a new airborne nuclear-headed ballistic missile.



TURBOFAN ENGINES on this B-52C test-bed will be standard on H models of intercontinental bomber now in production.



AERIAL LIFT has wooden bottom and a metal frame. It's equipped with hipper, hand supports, folding seat inside, and peep holes.

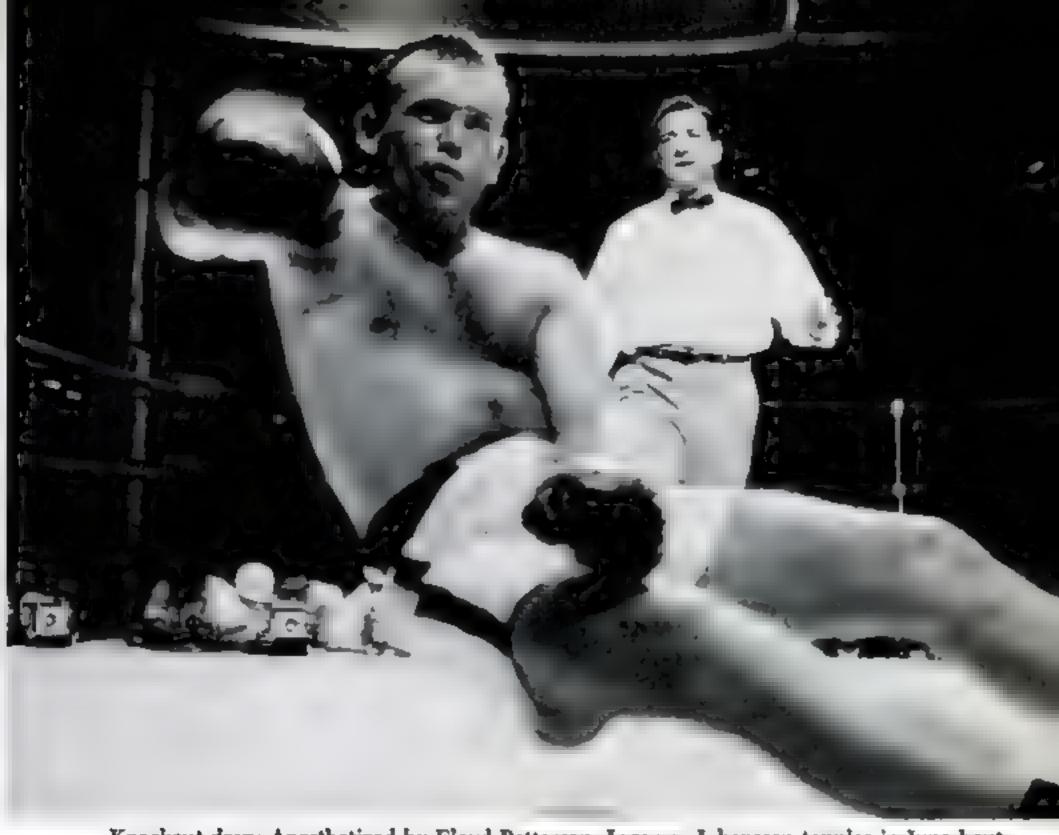


ROPE IS DROPPED FIRST. The man being rescued uses it to guide the device down. When he's inside, the bag is pulled up

#### Rescue bag

A new aerial rescue device —an overgrown, man-carrying duffel bag—is being tested by the Army. Like the harness now in use, the canvas bag is lowered from an airborne helicopter; but getting in and out of it is easier.

Materials for its manufacture cost less than \$10. The bag folds flat for storage.



Knockout drop: Anesthetized by Floyd Patterson, Ingemar Johansson topples in June bout.

## What Happens When You Black Out

it's not at all like going to sleep. And there are many causes—including some strange ones

By Lawrence Galton

BOXER takes a solid right to the jaw and kisses the canvas, out cold yet a minute or two later leaves the ring under his own steam.

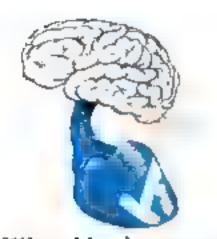
Even without stepping into a ring, few of us escape losing consciousness at some time or other ourselves—or witnessing and having to deal with blackouts in others. We fall off ladders, tumble down steps, the kids drop out of trees, we or they get beaned with balls—and the birdies sing. Blackouts are frequent in auto crashes and other accidents which yearly injure 10 million. They also go with some diseases.

Because of this, scientists have been checking into them. Here, on the following pages, is what they've been learning about this common phenomenon.



Maybe you fall off a ladder—and the birdies sing.

## How does a blow produce a knockout?



When blood pressure falls sharply, oxygen doesn't get to the brain.

The classical kayo punch in boxing lands "on the button" the point or side of the chin. The force is transmitted up and back to the base of the skull. In the process, a bundle of nerves in the neck—behind the angle of the jaw -suffers a heavy jolt.

These nerves control the blood pressure. With the blow, pressure falls precipitously. Without enough pressure behind it, blood can't push up against gravity to feed oxygen to the brain. The victim crumples.

It happens almost instantly. With some 10 billion sensitive nerve cells, the brain, of all organs in the body, needs the most oxygen. Even a fleeting lack of it will produce unconsciousness.

That's one way a knockout is scored. There's another. The scientific name for it is concussion.

### What happens in a concussion?

The word stands for a violent shaking up of the brain inside the skull.

You get a clear picture of what happens, suggests Dr. C. B Fausset of Indianapolis, if you think of a large earthenware crock full of Jell-O. The crock is the skull—and the Jell-O, with about the same consistency as brain matter—can be the brain

If you slide the crock along the counter, starting it gradually and letting it stop on its own, Jell-O and crock are always in contact with each other. But let the crock suddenly strike a solid wall and the abrupt stop will compress the forward part of the Jell-O and, at the same time, pull the after part away from the crock. The Jell-O has suffered a concussion.

In the brain, one particular area—the reticular formation—has the job of arousing you from sleep and keeping you conscious and alert. When it's deranged by concussion, you black out.



If a crock of Jell-O hits a solid wall, the sudden stop compresses it.

### How common are concussion blackouts?

Very Almost any solid blow on the head it can be a wallop with the proverbial rolling pin, a fall from a ladder, or even a stumble, trip, and bang—can do the job.

In auto crashes, 75 percent of all persons hurt suffer head injuries, according to a Cornell study. Some escape with minor bruises but often the quick deceleration pitches the brain forward inside the skull, producing concussion and blackout.

Among sports, football ranks next to boxing as a source of concussion—with tacklers, according to one recent study, running the greatest risk, followed by ball carriers, then linemen.

In many other sports, head against head and foot-againsthead contacts produce concussions. And a ball -it needn't be a hard one—can do the trick. In soccer, where players use their heads as bats, the ball takes off like a cannon shot after a hard kick. The leather-covered inflated blad-



Any wallop can do it.

der, in the early part of its flight, can be as effective in producing a blackout as a bean ball in baseball.

## How does a blackout differ from sleep?



It doesn't take much to wake you from a snooze—but a blackout is different.

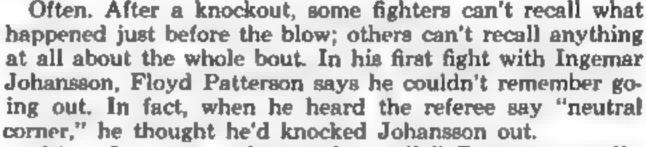
On the surface, one may seem like the other—but there's a big difference.

In sleep—which is a halfway state between consciousness and unconsciousness—many transactions between your brain and the environment dwindle away; just closing your eyes cuts off a great number of incoming impulses. But your sense organs still remain alert enough to respond to danger signals. It doesn't take much—often just a whisper will do—to wake you from a snooze. That's not true for unconsciousness. When you black out, you're literally out—out of reach of ordinary stimuli.

## Do the birdies sing?

Just before blacking out, you think you perceive a variety of sensations that medical men call "auras." You may hear birds—or other things that aren't there. And you may see stars or other visual hallucinations. Although it's relatively rare, some people even smell things that aren't there.

## Do memory losses occur?



"Then I got up and started to talk," Patterson recalls, "and I had this pain in the back of my head and I'd have laid odds that it was the referee who had clouted me there from behind."

Football players have been known to forget all details of the play that made them black out—even what happened in the dressing room after recovering consciousness.

Depending upon the severity of the brain injury, memory may be lost for long periods. Dr. Walter Alvarez of the Mayo Clinic tells of a 48-year-old man who, while horseback riding, was hit by a car, stayed unconscious for 18 hours, then seemed to improve. After a week, however, he still had no idea of where he was or what year it was. For three weeks his memory was impaired. Even after his recovery he could not recall the 10 days before the accident or his days in the hospital.



Football players often forget all details of how they blacked out.

## What are the other aftereffects?

Sometimes none at all. You may knock yourself out in a fall and get up a few seconds later none the worse for it. Many athletes, after being out cold, jump up and beg to keep playing—and some are allowed to and do a good job. On the other hand, there's nothing unusual about the case of a college halfback who struck his head on the ground

while making a tackle and was out for just a few seconds. Yet, for three days afterward, he felt drowsy, fatigued, unable to concentrate. After a week of rest, he recovered and completed the season in good shape.

# Are some people especially vulnerable to blackout blows?



One man passed out every time he backed out of his garage.

According to Dr. Soma Weiss of Harvard, there are people who have a more sensitive center of consciousness in the brain. It takes much less of a concussive jolt to affect it.

There also are individuals with an especially sensitive nerve bundle in the neck In experiments, investigators have been able to make such people pass out just by stroking the neck area a few times. One man who blacked out every time he backed his car out of his garage turned out to have a nerve bundle so oversensitive that just turning his head at an acute angle excited it and dropped his blood pressure, making him lose consciousness.

# How come an injury far from the head sometimes causes a blackout?

Shock is the reason. As doctors use the term, shock has nothing to do with emotional or electric shock. If you've ever felt a momentary weakness and faintness after, say, banging a finger with a hammer, you've had a touch of shock. It may follow even a minor injury, and it doesn't always produce unconsciousness. If severe, however, it can even cause death.

In shock, the brain doesn't get enough blood because the volume of circulating blood falls. That can happen three ways. You may lose blood by hemorrhaging—internally or externally—after an injury. The average 150-pound person has 10 pints of blood. Loss of just one pint sometimes can induce shock; loss of three pints almost invariably does

You can also go into shock if you lose a lot of water through excess sweating, large-scale vomiting, or diarrhea This pulls fluid out of the blood and cuts down the blood volume

The third way is through pain. Pain can set up nervous reflexes that expand blood vessels. When fully expanded, vessels in your muscles alone can hold three pints of blood—and those in the abdomen can hold all the blood in the body. That leaves little or none for the brain.

To combat shock, the head is lowered to help get blood to the brain, blood transfusions may be used, or large amounts of fruit juices may be given if there has been dehydration.

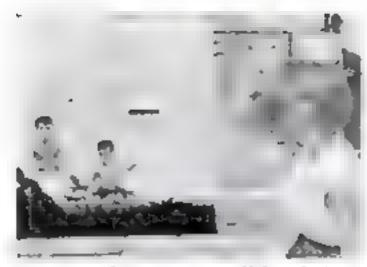


That momentary weakness after you banged your finger with a hammer was a touch of shock.

## How do emotions trigger blackouts?

Emotional blackouts commonly occur when there is some danger, real or fancied, and no escape or action is possible—

[Continued on page 226]



NO NEED for mom to call her kids in from a dip. She just presses a button and the elevator platform lifts them clear out of the water.

## Elevator covers swimming pool

The bottom of this swimming pool is also its lid. The platform is made of spaced nonskid-aluminum boards. It can be raised or lowered electrically by pushbutton control and locked at swimming or wading depth, or on top of the water.

The platform was designed by Safety Pool Lift, Inc., Hialeah, Fla., and the model shown herefor a 15-by-30-foot rectangular pool—sells for \$1,500.



ELEVATOR LID LOCKS on top of the pool to become a dry patio for entertaining guests after a swim. It also keeps neighborhood children and pets from falling in.



#### Room without echoes

Antennas for advanced aircraft and spaceships are tested in this 40-foot chamber specially designed for beaming radio signals at models. The enclosure, built by Republic Aviation, eliminates external interference. The Coke-bottle shape of floor, walls, and ceiling absorbs radio waves and makes the room almost completely echo-free.



#### Dual-purpose garage door

The top-hinged garage door above swings up to provide a covered work area or a port for a guest's car. It's a British design, made of steel panels, and is supported by hinged struts guided in vertical channels. Counterbalancing is done through cables attached to a single weight along one of the walls.

#### PS PICTURE NEWS



#### Newest antisub rocket

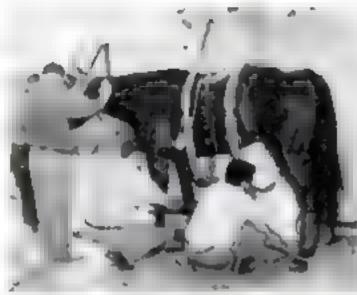
Here's a close look at the ASROC (antisubmarine rocket), the Navy's latest and deadliest answer to the aubmarine threat. Poised and ready for loading, the missile is undergoing tests aboard the U.S.S. Norfolk. Its solid-propellant rocket carries a homing torpedo thousands of yards to the target area. There, rocket and air frame fall away, a parachute lowers the torpedo into the water, and a homing device locks on the target. Minneapolis-Honeywell developed the missile.



#### What's missing here?

No, this car didn't lose its front right wheel in a freak accident. It was taken off deliberately by Chrysler engineers in a stability test of this year's new unit-body construction.

To counterbalance lack of support up front, the engineers loaded the trunk of the car with a ton of weight and then drove from Chicago to Detroit in 9½ hours, using turnpikes and averaging 45 m.p.h. for most of the trip.



BUNDFOLDED AND TRANQUILIZED, a race horse is securely strapped to the upright table top.



TABLE IS TILTED to a horizontal position. Mounted on a truck, it permits surgery right at the track.



on horse's leg. Dr. R. J. Keeran, the surgeon, is also the inventor.

#### Operating table keeps horses in races

Many injured race horses that ordinarily might have to be destroyed may now be saved with a tilting hydraulic operating table. The truck-mounted unit is in use at Detroit's Hazel Park and tracks of the Michigan Racing Association. The horse above is having a bone splinter removed,

## New Ideas from the Inventors

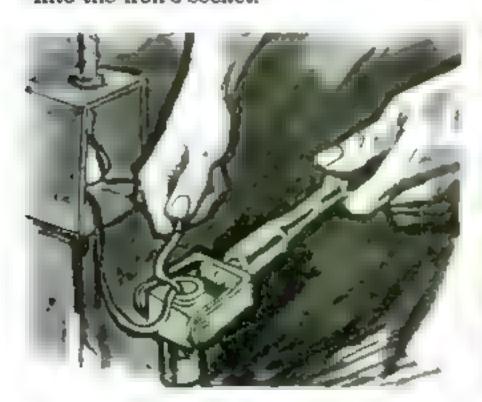


Vacuum Collects Fallen Leaves. Parked cars that prevent sweeping of leaf-cluttered gutters wouldn't keep this mobile vacuum cleaner from doing its job. The

recently patented motor and blower assembly could be mounted on a standard dump truck. It would feed collected leaves into the truck's storage chamber.

Solder Pot Heated by Iron. You could make quick and secure electrical joints by dipping wire ends into this soldering pot. To use it, you'd unscrew the regular soldering tip from your iron and insert the shaft of this heat-conducting frame into the iron's socket.

Magnetic Goggles Catch Chips. The magnetized sidepieces of these safety goggles might give you extra protection against flying chips of iron or steel. Particles whirled toward your face by a grinding wheel, say, would be drawn to the magnet and held there for safety.





#### More Inventors' Ideas



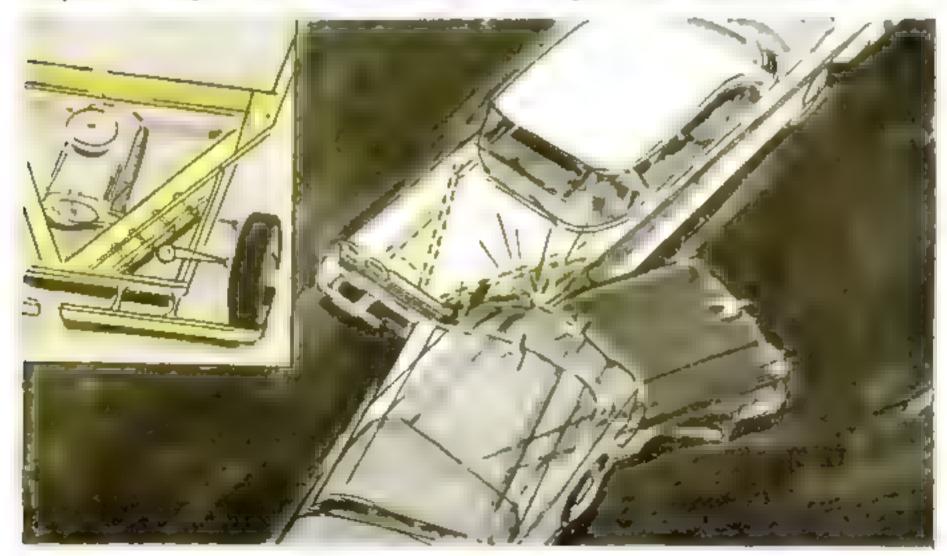
Skate Hee! Stops Flops. Learners—and experienced skaters—could avoid painful back-spills on skates equipped with this brake. If a skate started to run out from under you, the base of the brake would hit the ground to slow the runaway wheels and restore your balance.



Blind Comes Apart for Cleaning. Pulling the spring clips off the ends would free these Venetian-blind slats from the rigging cords. They could be drawn out of the laddered tapes for easier cleaning. The come-apart construction would also ease cleaning or replacement of the tapes.

V Frame Cuts Crash Damage. You'd have a better chance of escaping collision injury in a car with this safety frame. Separate bumper and axle assemblies

would be fastened by shear bolts. When severed by a crash, the nearer assembly would slide back at an angle to deflect the impact and reduce its force.





Heater Attachment Warms Bottle. With this bottle-holding cylinder mounted in front of the fan casing of your car heater, you could warm a baby's bottle during a trip without taxing the electrical system. The slide-on attachment could be quickly removed when not needed in the car.

Signal Shows Phone Has Rung. You wouldn't have to guess whether you had received an expected call while you were out if your phone rested on this base. A vibration-sensitive switch would turn on the indicator light; a reset button would turn it off. If you used a phone-answering service, you'd know at a glance whether or not to check your calls.





Canoe Seat Attaches Oarlocks. You could paddle your canoe, or row it when you wanted to make better time, by slipping this removable seat on or off. Held in place by the rower's weight, the seat braces would stiffen the canoe's sides and also pivot the oars for rowing.

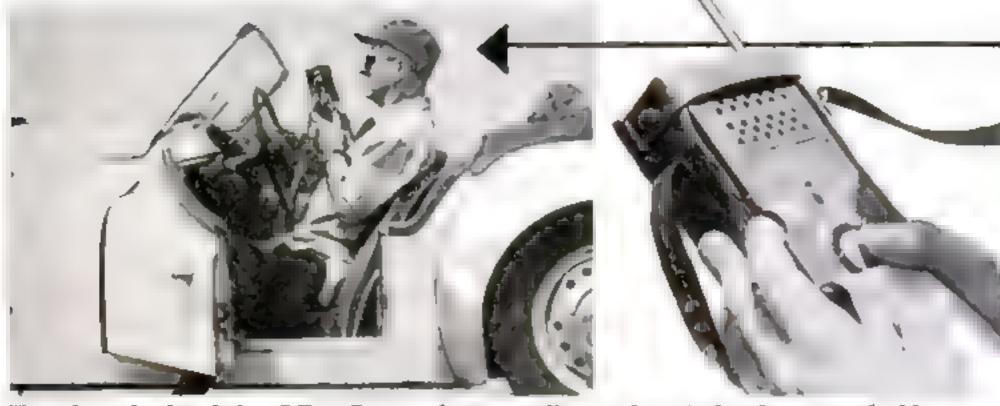
The following petents have been issued on these inpentiones: Loui element—No. 2,863,847 to C. F. Hobbs, N. Sacramento, College; Solder pot—No. 2,866,121 to S. H. Sachet, New Orlege; Googles—No. 2,820,327 to M. Singer, Portland, Ore.; Shate brake—No. 2,872,201 to S. T. Nagers, Finston, Ky & Blind—No. 2,868,384 to H. F. Union Bettaire, and A. E. Long, Shadvade, Ohio; V. Irame—No. 2,866,355 to F. W. Bohn, Screeton, Pa.; Bottle warmer—No. 2,811,963 to J. R. Falloma, Prietriburg, Ind.; Phone signal: No. 2,813,154 to J. Rahmow, Takoma Park, Md., Quelocks—No. 2,815,517 to J. R. Andresen Jr., Greenwood Lake, N. 1.

Copies of patents may be ordered, by number, from the Communicaner of Patents, Washington 25. D.C., at 25 cents each, To write to an inventor, if the address given above is insoficient, you may address him (by name and patent num-

ber) in care of the Commissioner of Palents.

## Personal Two-Way Needs No License

## Radio



"I read you loud and clear." To talk, press button; to listen, release it. Speaker at top doubles

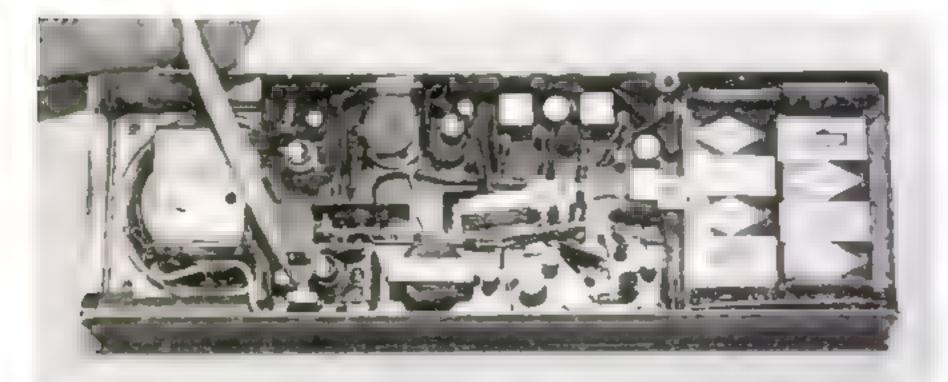
OULD you use a personal intercom that tucks in your coat pocket and would let you talk to someone a mile away just by pushing a button?

If you read Dick Tracy, this may sound like old stuff. But until recently, if you went out to buy a gadget that would duplicate the feats of the comicstrip wrist radio, you'd wind up with a hefty double handful of electronic gear costing more than a good TV set—and you'd have to get a license before you could use it. The weight of the batteries alone would be enough to discourage

you from making it a part of your everyday wardrobe.

By the time you read this, if manufacturers' plans stay on schedule, practical personal two-way radio communication will have achieved a new degree of freedom. The instruments weigh less than the average camera and probably will sell for around \$100. You'll need no license of any kind. They're simpler to use than a dial phone.

An obscure paragraph (heretofore unexploited) in Part 15 of the regulations of the Federal Communications Commus-



TINY QUARTZ CRYSTAL (at pencil point) holds transmitter on frequency. Two six-volt batteries

(right) power the transceiver, made by Radio Mfg. Engineers, Washington, Ill.



as mike. Volume control is above button.

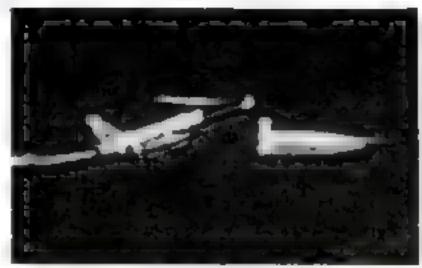
sion makes them legal; new transistor circuitry makes them technically feasible.

The pertinent rule says that no license is required for a "low-power communication device" if the transmitter adjustments are sealed by the manufacturer and certified to comply with the operating conditions specified by the Commission.

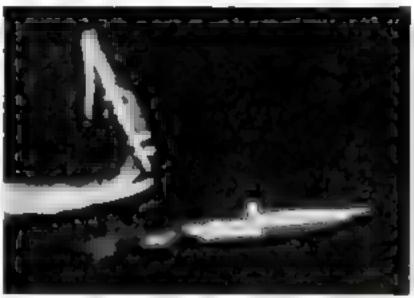
These flea-power transceivers use the same frequency channels as Citizens Band service. In fact, you can get a Citizens Band license for them (if you are over 18) that will permit you to answer and talk to regular licensed CB stations; without a license you can only listen to them. With or without a license, of course, you may talk to anyone using similar equipment to yours.

The main difference between Part 15 and standard Citizens Band equipment is the size and power requirements of the transmitter. Regular CB transmitters are invariably built to deliver full legal power allowed under their license. This means using vacuum tubes—transistors don't have the muscle. Consequently, almost all standard CB transceivers are built to operate on 115 volts AC. You can have them in your car or boat by using an inverter—but you can't carry them in your pocket.—Robert Hertzberg.

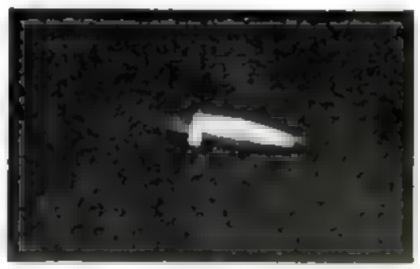
#### Nose cone breaks off, heads for target



1. ICAM SNARK, on signal from guidance system, releases nose cone with dummy warhead while still miles away from its target.



2. WARHEAD STREAKS OFF on ballistic trajectory, leaving the guided airframe to fall to earth and cause confusion to enemy radar.



3. SUPERSONIC SPEED is attained by dummy nuclear nose. Snark has demonstrated accuracy on targets over 5,000 miles away.

First photos of separation of a nose cone from the Air Force's Snark show how its warhead is detached from the Northrop intercontinental ballistic missile and sent on to its target. The missile is guided to this point, releases its warhead on signal, and sends it on a ballistic trajectory. The Snark, operational at Presque Isle Air Force Base, Maine, showed pinpoint accuracy in long-range test launchings.

## WHAT'S NEW.



## Do-It-Yourself Aluminum House

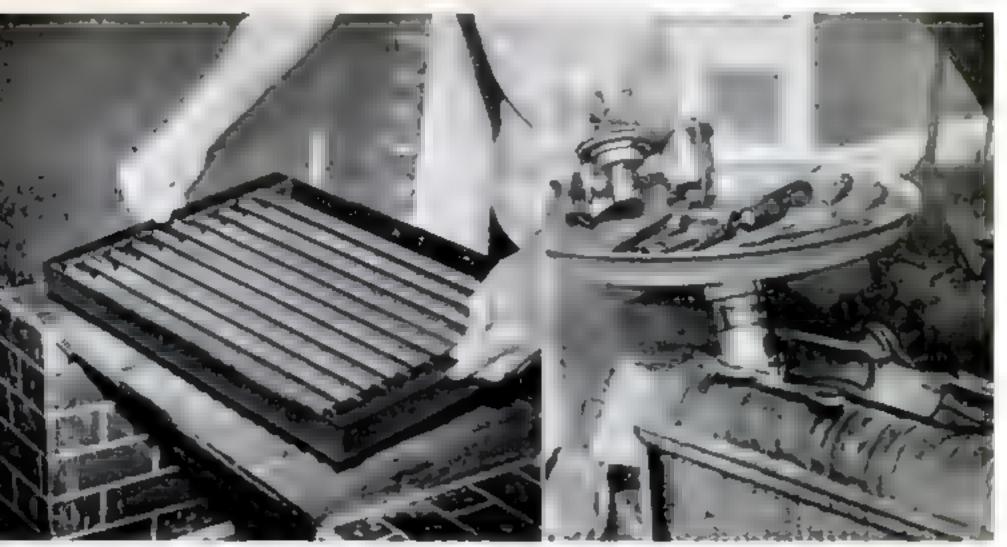
With a single helper, you can put up this prefabricated five-room house in just five days. It's built of interchangeable panels, faced on both sides with bakedon color-finished aluminum, insulated with a 11 pinch cushion of styrofoam,

and locked together like a toy construction set. The model above costs \$5,500 without the lot. Other, smaller ones are \$3,500 and \$4,700 All have fully screened porches Florida Industries, 4503 W. Alva Ave., Tampa, Fla.



NO-HANDS LEVELS are edged with a magnetized vinyl-plastic strip of the kind used to close refrigerator and screen doors. They cling to upright and horizontal steel members, leaving hands free. In 12-, 18-, 24-, and 48-inch lengths, 85, \$6, 87, and \$12.50. Empire Level Mfg. Co., Milwaukee, Wis.

STATION-WAGON BUNK fits on the front seat and windows of any domestic station wagon to provide upper-level sleeping for two, leaving room on the floor for two more. Roll-up canvas on a 50-by-75-inch tubular-steel frame covers a center dividing bar, \$37.50. Griffith Tool Co., Villa Park, Ill.



BARBECUE GRILL consists of a series of V-shaped louvers in a 14 by 22-inch steel frame. They channel drippings to the sides instead of into the fire, preventing flare-up, smoke, and burning Price, \$8.95; stainless, \$16.95. Cast-iron grate, \$4.70 extra. M & B Sales Co., 2615 Love Field Dr., Dallas, Tex

TOOL TRAY fastens on intake spout of a car radiator to keep parts and tools handy on tune-up and repair jobs. The tray can be leveled on any car and is detachable from the stem so a second tray can be substituted. It costs \$12.95; extra trays \$5.95 each. B & M Mfg. Co., Box 746. Winston, Ore.



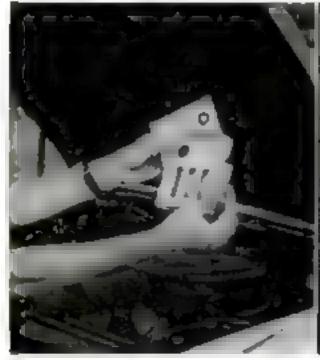
RIGHT-ANGLE DRIVE for <sup>1</sup>, inch power drills is reversible, doubles speed for finish sanding, or reduces it by half for drilling large holes or buffing. It fits directly on a male or female spindle, uses drill's own chuck for bits or attachments. Price, \$4.95. The Stanley Works, 111 Elm St., New Britain, Conn.

SLIDE-RULE TIE CLIP is a practical as well as novel accessory. It is calibrated accurately, and the slide is movable to work out answers to mathematical problems. A magnifying indicator makes results easy to read. Gold-plated, \$1.50; sterling, \$3.95, plus tax. Mother Hubbard, 10 Melcher St., Boston.



## Dual-Temperature Heating Tray

A hot spot blended into the radiant glass panel of this new tray stays 40 degrees hotter than the setting for the rest of the panel. An adjustable thermostat regulates the server from room temperature to 265 degrees, and a pilot light glows while the tray is turned on. \$39.95. Salton Mfg. Co., 519 E. 72 St., NYC.



LUBE TESTER tells the condition of oil in your engine. It uses two tests: a fluid in which three drops from a dip stick are shaken to show acids, and a paper on which a drop shows solids or water. Kit for three tests, \$1. Gordon Laboratories, Annapolis, Md.



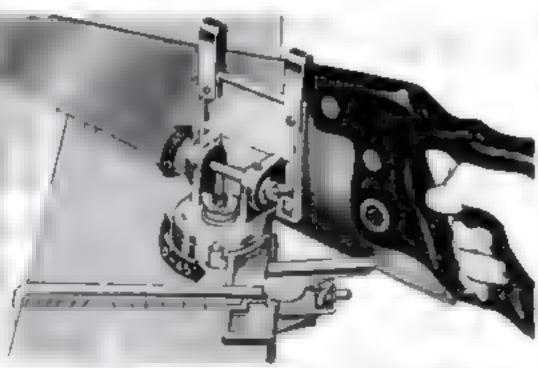
canned cedar closet of any closet in the house. It is pulverized aromatic cedar wood. Mixed with water, it sprays or brushes on like paint. Four-pound can (covers 60 square feet), \$6.95. Cook Enterprises, 54 Holland St., Asheville, N. C.

VINYL SURFACE on gypsum board provides stainproof, washable decorative finish. It's handled like other gypsum; nails or cements to study or existing walls. Sheets are four feet wide, come in five textured colors. National Gypsum Co., Buffalo, N. Y.

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BRUSH-ON MASTIC is dabbed on ceiling tile and requires no apreading with a toothed applicator. You then staple the tile to hold it until the cement sets. There's no need to remove old paint and wallpaper unless badly pee'ed. Per gallon, \$6.95; per quart, \$2.75. Armstrong Cork Co., Lancaster, Pa.



MITER GAUGE can be used with any saw having a blade up to 4¼ inches deep. It consists of three metal parts: clamping base you can attach to stock up to 1½-by-8 inches, swivel base notched in 5-degree calibrations from zero to 45 degrees, and backing guide and plate for holding saw on angle pivots with wing-nut adjustment. \$6.95. Nielsen Saw & Mfg. Co., 2395 W. 7th St., Eugene, Ore.



LIGHTED SHAVER has two flashlight bulbs near its rotary head to give you shaving light in a dim or dark room. A pull-apart base contains a nickel cadmium battery good for up to 10 shaves. It plugs directly into outlet to recharge. German-made AccuMen costs \$25. Monroe Hattenbach, 347 Fifth Ave., NYC.



VENETIAN - BLIND KIT contains plastic supports that replace torn cloth ladders that allow slats to droop. You cut out the old support, insert a plastic one, and fasten it by pushing a staple through the cotton or plastic tape into two holes in each end of the ladder. A kit with 12 ladders and a supply of fasteners sells for 39 cents. Slat-Fix Co., 72 Spruce St., Hicksville, N. Y.



**BAGGAGE CONTAINER** is pushed gently down a Jeep-mounted conveyor uosed into the cargo hatch of an incoming jet airliner.



PLOTATION is provided by lowpressure air supplied by a compressor installed on the Jeep and driven by its power take-off.

#### Baggage floats off jet

Luggage going on or off TWA's transcontinental DC-8 jets now floats through the air like seeds in a milkweed pod. The system, developed jointly by TWA and Douglas, unloads incoming planes and delivers baggage to the claims desk



Wing-tip fuel tanks are supported by wings of their own . . .



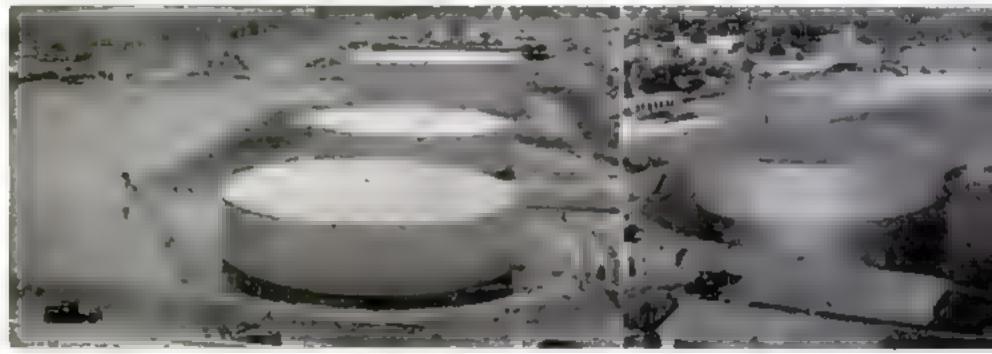
. . . that are hinged to lessen strain on landing.

#### Wing tanks ride on own wings

Extra fuel tanks on the wing tips of this Beechcraft Twin Bonanza are supported by their own wings, so as not to add strain to the plane's wings. The extension wings are hinged to let the tanks touch ground on individual retractable wheels when landing. The Army is testing the device in the hope of lengthening the range of small aircraft.

#### Ingenious way to move an oil-storage tank

When a 55,000-gallon oil tank had to be moved 850 feet, engineers built a lake on which to float it to its new location at Riviera, Fla. First they threw up a dike

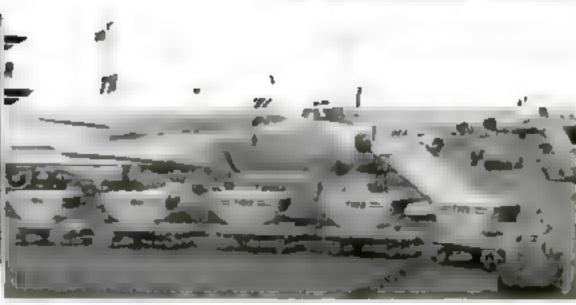


1. The floating operation begins for the big tank.

2. Crucial moment in moving



four Gupt-Aire PADS on the underside blow air cushions from center nozzles. By eliminating friction, they make moving easy.



STRING OF DOLLIES, each carrying one baggage container, is houled to the terminal to speed delivery to passengers.

in six to eight minutes. It utilizes four Glide-Aire pads—Ford's ground-effect mechanism—on the bottom of fuselage-shaped aluminum containers. Floating

makes them easy to push out of a cargo hatch and down a Jeep-mounted conveyor onto dollies. Air for flotation is provided by a compressor on the Jeep.

#### Mammoth lid for nuclear reactor

This huge 1,500,000pound concrete cover rolls
on 104 wheels. Shut, it
helps seal in radiation from
an underground nuclear reactor at Convair's plant in
Fort Worth. A push of a
button moves the 332-cubicyard lid from full-off to
full-on position in eight
minutes. An old World War
II B-24 bomber assemblyline puller does the work.



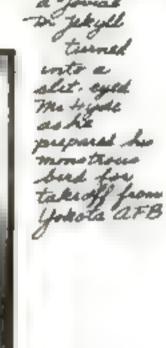
for banks, covered the area with plastic sheeting to forestall seepage, and then pumped in 5,500,000 gallons of water to a depth of five feet. From there on, the going was easy. A crew emptied the 28foot-high, 128-foot-diameter container, attached cables, and hauled it with three tractors. The job took 4½ hours.



as it rounds right-angle bend.

3. In place at last. The man-made lake was then drained.

## P\$ reporter's first-hand story of a record-smashing





Electrical specialist Egt. John Kelsey had inspected the alling jet pod and pronounced it "well"

# Tokyo

#### By Frank Harvey

OW long is the runway?" I had asked Capt. Joe Blaylock.
"11,700 feet," Blaylock said.
"No sweat."

But I did sweat a little. The Saucy Sixty, a KC-135 jet tanker, was loaded as heavily as any plane Blaylock had ever flown in his long career in the front cockpit of jet tankers. There's more than 7,000 air miles between Tokyo, Japan, and Seymour-Johnson Air Base, North Carolina. We'd be flying it nonstop and non-refueled

There was another spice to this trip: We hoped (dimly) to break the long-distance unrefueled speed record from Japan to the east coast of the United States. Our three navigators, Maj. Marion Ward, Lt. John Trask, and Lt. Don Huggins, had huddled in the weather office peering wistfully at jetstream wind patterns we might hope to pick up en route.

"Not much chance, actually," Trask had said. "The jetstream winds are light in summer. We'll be lucky to get a little 50-miler on our tail."

As aircraft commander, Joe Blaylock had gone through a complicated mathematical computation involving the gross weight of the plane, the altitude of the field, the temperature of the runway, the wind conditions, the extra push they could expect from water injection, and half a dozen other items. The figure of 9,400 feet emerged. This was the point where we could expect the Saucy Sixty to stop rolling and start flying.

"That's if we have our expected temperature of 67 degrees Fahrenheit," Blaylock added, almost as an afterthought. "If it's hotter, we'll have to roll a bit

farther, of course."

I didn't ask any more questions. Better to climb happily aboard, not sweating, than get involved in an iffy matter like

# to Carolina in $12\frac{1}{2}$ Hours

engine failure just before you reach 9.400 feet, with you moving about 200 m.p.h. and weighing (as they had said) 278,000 pounds. Or think about how you'd stop this monster before it porpoised off through the fields into the mouth of that railroad tunnel located (as the Yokota Air Base ops officer had pointed out) just off the edge of the field.

Trouble in No. 3 pod. About 40 minutes before takeoff time, Sgt. Donald Winch, assistant crew chief, found a puddle of oil under the No. 3 jet pod. Sgt. Buron McKissack, maintenance boss of the plane, came over for a look.

"I don't think it's anything serious," McKissack told his crew, "but I reckon

you boys better pull the covers."

I watched Winch, McKissack, et al, unscrew the covers of the jet pod and stare into the front end of the compressor. Winch took a rag and wiped up some oil at the base of the blades. All hands peered interestedly to see if more oil would collect. None did.

"No problem," McKissack announced stoutly. "Probably just overfilled. Button her up, men, and let's give her a test."

But 40 minutes later, sitting in the jump seat just behind Capt. Blaylock and co-pilot Bill Bry, I was still thinking of No. 3 (even though Winch, Mc-Kissack, and electrical specialist Sgt. John Kelsey had tested her, and she'd

screamed very faithfully).

Joe Blaylock, a smiling and relaxed Dr. Jekyll when you had a beer with him in the Officers Club, had somehow turned into a curt, slit-eyed Mr. Hyde as he finished up his preflight check and prepared to commit his monstrous bird to takeoff. I heard him say to Bry on the intercom, "Now get this. We need 118 knots at No. 7 marker. If we haven't got it-if we're even five knots ahy-we abort. Understand?"

"Yes, sir," Bry's voice answered crisply. "We figured the takeoff roll for 67 degrees F.," Blaylock said. "Operations said we have 70."

"We had 70 at the briefing, sir," Bry

said. "We have 72 now."

How much farther, I wondered, must you roll if you have 72 instead of 67?

Toeing the mark. Blaylock used every inch-right down to the green marker lights—when he turned upwind. And then he halted way off on the side, with the nose pointed toward the center stripe. "May need the extra feet," he told Bry. "I'll line up after we start rolling."

We sat there, the sound of the jets feeble and remote through my padded earphones. Ahead, the runway, marked with the black-rubber burns of thousands of landings, disappeared into the Tokyo

murk.

"Four minutes to takeoff," Blaylock

I felt a hot trickle dart out from under one armpit and coast down my side. Joe Blaylock was probably right about the length of the runway, but he'd miscalculated the sweat threshold of at least one of his passengers.

"How's she look?" Blaylock asked after

"Green across the board," Bry said in a tight voice.

"We're two minutes early," Blaylock said, "but we're cleared. Let's roll it . . ."

His right hand moved the nest of throttles forward, and the feeble hissing of the jets rose to a blowtorch roar. The big plane trembled and tugged as Blaylock held it with brakes. The needles of the four duals that showed the percent of power the four jets were putting out moved reluctantly upward-and stopped well short of the top.

"Water," Blaylock anapped

Bry flicked a switch and something

### At 278,000 pounds, we needed every inch of runway

Aweary
passenger
loses
interest
in
Fandange
Rock



asit Navigator 5 to Winch



Buran Me Kissach Bell Bry



Mr. K. ch inspects his spare tires brought along in case of failure oversess that resembled a controlled dynamite blast took place in the engines as water injection began. The power needles hastened up the dials to the top. The big tanker was vibrating savagely. Joe Blaylock lifted his toes and we began to roll—so fast that my body sagged in the jump seat as we angled in and picked up the center stripe.

"Coming up on decision marker," Bill Bry's voice came, clear and sharp, over the intercom, "Coming up on Marker 7

... 3,800 feet ... now!"

We'd made our first hurdle. We had 118 knots. The concrete raced under our nose. "Coming up on critical engine failure," Bry said sharply—and in an instant, "Now!"

The takeoff. Blaylock's hands left the throttles and took the yoke—and Bry's hand was on the throttles a split-second behind. I could see the end of the runway, rushing at us. We made no effort at all to leave the earth. Then the big nose hid the rest of the runway and all I could see was a Japanese highway with little cars according along it, and behind the highway the high mouth of a rail-road tunnel.

Joe Blaylock's shoulders hunched back and he pulled powerfully on the yoke. The tanker's nose tilted high. I felt a wallowing motion, heard the wheels thump home, and then came the thrill. No clawing desperately over the rim of the tunnel with this bird. She lifted clean and alive like a fighter, heavy as she was. We were 500 feet above the tunnel when we passed it, easy, safe, no sweat, exactly as Joe Blaylock had predicted.

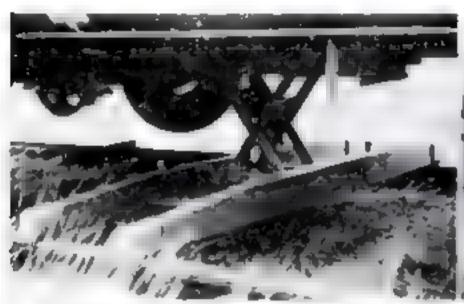
Flying in a windowless jet tanker is roughly like sitting on the floor in a noisy toolroom. Unless you're up front, you have no sensation of motion after you climb into the smooth air of high altitude. You drink more coffee than you need, just to be doing something. You shiver, even sitting under a heater. The lights are so poor it's asking for a headache to try to read. The smart thing to do is sack out, but on this trip there was just one bunk—and it was reserved for co-pilots Bill Bry and Lynn Dyes, who spelled each other during the flight.

[Cantinued on page 230]

[3] POPULAR SCIENCE OCTOBER 1960



1. Converted Volkswagen drives across track of Long Island Rail Road.



2. It's raised on jack, swung 90 degrees.



3. Flanged wheels lowered, it rides on rails.

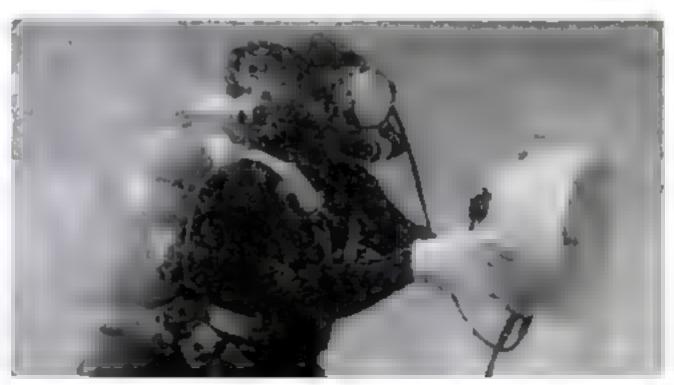
### VW gandy wagon

Volkswagen station wagons and pickup trucks have replaced the old handcars on New York's Long Island Rail Road. They are equipped with retractable flanged wheels to supplement those with rubber tires so they can ride on rails as well as highways. With the vehicle straddling the track, a built-in electric turntable jack raises it and spins it 90 degrees to set it on the rails. At end of line, the jack can turn the VW completely around to start it on its return trip.

#### Navy frogmen carry ears

New portable sonar equipment is tested at right by a Navy frogman for locating objects under water.

Reflected sound waves from its searching beam are transmitted to the diver through earphones. The device is battery powered.



F. C. HAVECKER, retired inspector for a rubber manufacturer, interrupted his gardening to bring out chairs for the interview.



Did you pay any attention to the Democratic Party convention!

criticized the President . . telling Russia hou ill-prepared we are and everything else . .

INSURANCEMAN H. J. WITTENBAUER switched off the TV (he was watching the Republican platform deliberations) and came out on the porch.



Do you approve or disapprove of the way Eisenhouer is handling his job as President?

Approve . . . He's very loyal, doing everything he can for the betterment of the country.

# How Those Political Polls Work...and how good

#### By Martin Mann

R. GEORGE GALLUP is solemnly forecasting the outcome of next month's presidential election. Elmo Roper is doing the same. Can they really tell?

Many people trustingly accept political surveys as precise measurements as accurate as figures from the National Bureau of Standards. Others laugh them off as high-class tea-leaf reading, dressed up with scientific hocus-pocus. The truth is, they're a little bit of both. Political politing is cousin—but not twin—to the science of statistics.

Here are the straight answers to blunt questions about the surveys: what they

do, how they do it, where they can go wrong-and why.

How can poll-takers tell how I'm going to vote if they don't ask me personally?

They can't. Surveys gauge the opinion of the entire public, as a group, and don't try to specify separate, individual opinions. It's like flipping pennies. Out of 1,000 tries, about half will come up heads and half tails—but you can't predict which way any one penny will come up.

Why don't they interview me?

Each nationwide survey asks its ques-

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#### ROUNDS WITH THE GALLUP POLL

"I'M A GALLUP REPORTER" is Pauline Fay's introduction of herself when she calls to ask people how they'll vote. Poll responses are confidential. The persons shown at left and on following pages gave PS special permission to take pictures and quote their statements.



# are they, anyhow?

tions of 1,500 to 3,000 people. This sample is such a small fraction of the population that there's very little chance you will be included. Even if 10,000 people were questioned every week, it would take 200 years to get around to every adult in the country.

# Only a few thousand people? Is that really enough to measure the whole country?

Theoretically, it's plenty. With a sample of this size the theoretical odds are 20 to 1 against an error of more than three percent. And they're 100 to 1 against an error of more than five percent.

The hardest thing to believe about

surveys is that huge numbers are not needed for accuracy. Neither will large numbers balance out other mistakes in a poli. The 1936 election survey of the defunct *Literary Digest* polled 2,376,523 people—and was wrong by a whopping 19 percentage points, picking Alf Landon to win over Franklin Roosevelt.

## Why? How can a few people speak for millions—accurately?

Too few can't. But accuracy goes up sharply when the sample increases moderately.

Suppose you pick 10 pennies out of a carload and flip them. There are 1,024 possible combinations of the individual

#### MOST PEOPLE READILY ANSWER

MRS. ESTHER JOHANSON, wife of tugboat fireman-engineer, was reluctant at first, but soon warmed up to the idea with pointed comment.



Which man-Nixon or Kennedy-do you think has the better TV personality?

That's a difficult question to answer ... Nixon is a pro. He has more finish and polish. Kennedy relies more on boyish charm

YOUNG GRANDMOTHER, Mrs. Mary Maschi, was on vacation (from electronics plant)—but minding grandchildren. That's Benjy, age 1, on lop.



Which political party do you think can do a better job of handling the problems facing this country today? The Republican Party or the Democratic Party?

Well I'm a Democrat . . . So I think the Democratic Party can do a better job

pennies (10 2s multiplied together). The chance of getting 60 percent or more heads is two in five. That's a fairly good chance, and you wouldn't be too surprised if you did get 60 percent or more heads in 10 tosses purely by luck. It wouldn't mean a thing

But suppose you flip 2,000 pennies. There are an unimaginable number of possible combinations (2,000 2s multiplied together, which is 10 followed by 602 zeroes). There aren't nearly so many ways to end up with 60 percent or more heads. The chance of tossing that many heads, purely by luck, is very, very slim—about four in a thousand.

But how can anyone be sure that a sample, whether pennies or people, is a true cross section?

By picking it at random. That brings the laws of chance into play again. There's just as much chance of picking one as any other. The odds are all against picking a biased sample if the choice is genuinely random.

Strangely, it doesn't matter much how big the whole lot is. A sample containing 2,000 pennies will be almost as represent-

ative of a billion pennies as of a million—if it's truly random. Making the selection random is like mixing soup: One spoonful is enough to taste a plate of soup—or a pot full or a vat full, if the soup is well mixed.

Wait a minute. People aren't uniform like soup or stamped out identically like pennies. How can mathematics based on coin-tossing be applied to something entirely different?

There's not as much difference as you might think. Pennies aren't necessarily identical—you can tell whether they are or not by flipping a sample group.

Forecasting votes is particularly like testing pennies. For all practical purposes, both are "either-or" cases: heads or tails, Kennedy or Nixon.

How do the pollsters get a well-mixed spoonful of people—a true cross section of the whole country?

It's complicated, because serious mistakes are easily made. First, the U. S. is divided into 20-odd areas. For each area a list of counties is made. Now the sta-

#### EVEN PERSONAL QUESTIONS

POLICEMAN HERBERT C. DAVIS was reading the newspaper on his stoop (assisted by 2½-year-old kathy) when Mrs. Fay came up the walk.



What do you think is the most important problem lacing this country today?

... The problem of communism and its spread throughout the country. I don't think it's anything to do with party . . . it's the job of the FBI. They have nothing to do with politics. MRS. VINCENT TERRACIANO, wife of a salesman who is active in local politics, held firm opinions. Her vote was already committed.



What do you think was the best argument to get people to vote Democratic this November?

There are so many issues ... I'm trying to think ... I like Kennedy. I like him very much. I think he's got a lot of stamina. He knows what he's saying.

tisticians pick a number out of a book of random numbers—a fancy way of pulling a number out of a hat.

The random number serves as the key. It tells which counties are to be used, and also whether city, town, or rural residents of those counties are to be interviewed.

The drawing process is repeated, using U.S. Census maps, to select Census "tracts" within the chosen counties, and then city blocks or rural sections within the chosen tracts.

In the block (or section), the poil takers ring successive doorbells until they get 8 or 10 interviews. They work afternoons, evenings, and weekends to catch working people at home. The ultimate selection of a particular person follows some simple rule, such as: one day choose the oldest adult woman then at home; the next day choose the youngest adult man.

This method is hardly foolproof—particularly in the last stage, which depends on people—specifically the housewives and schoolteachers who work at interviewing in their spare time. It selects a cross section that is only a fair approximation of the ideal sample required by

the mathematical laws of probability making actual error greater than theoretical error.

Hold on, This sample that's chosen so laboriously . . . It's a cross section of adults. But not all adults vote. Doesn't that throw the political surveys way off?

Very embarrassing question. There's no law in the U. S. forcing people to vote, and about 40 percent of those eligible don't cast their ballots. That 40 percent punches a hole in a survey big enough to drive a troop of dark horses through.

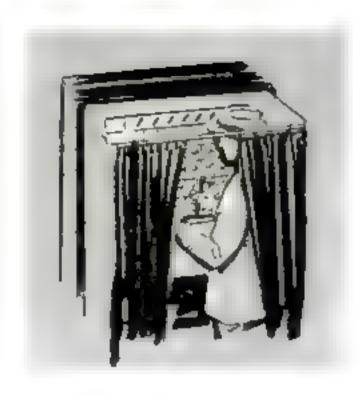
For example: Suppose a poll of 2,000 people reveals that 1,100 prefer Candidate A and 900 prefer Candidate B. But about 800 of those 2,000 won't vote. If most of the nonvoters are supporters of Candidate A, his less popular opponent will win easily. Only votes count.

Now what? How can pollsters get around the nonvoting 40 percent?

Simple. Throw them out—that is, exclude the replies of the people who won't

[Continued on page 236]

# How a Voting



TEXT month thirty million Americans will vote by flipping machine levers. Every vote will count, Unlike ballots, machines permit no disqualifying mistakes.

The first voting machine was used in an election in Lockport, N.Y., in 1892. Today machines are used in all but five

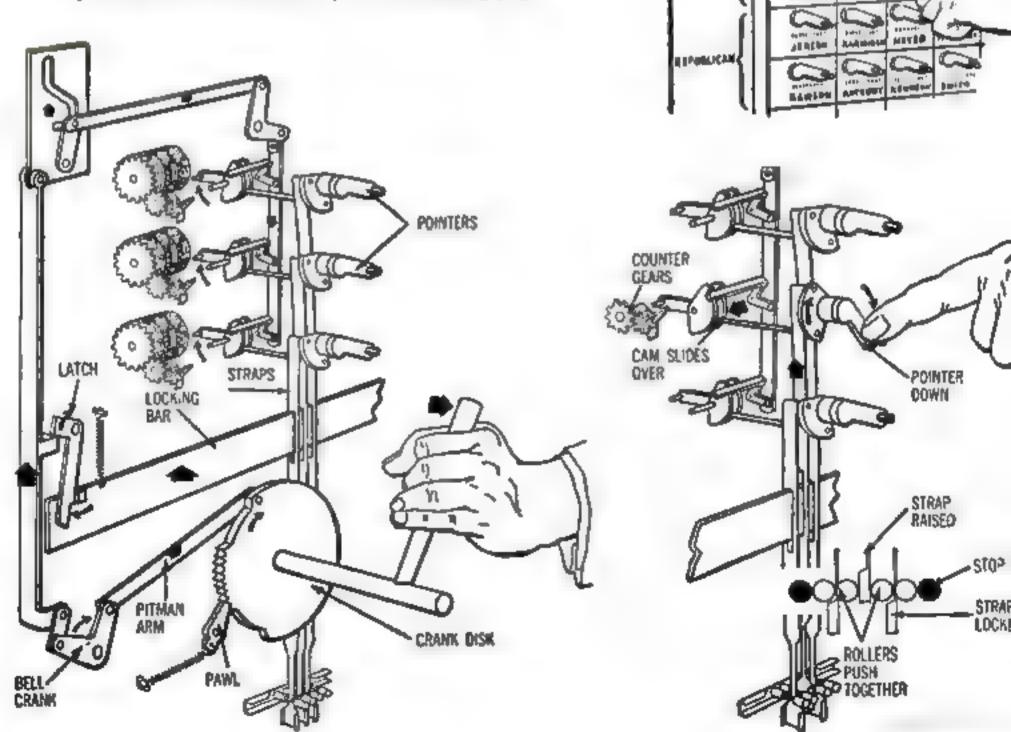
M HISCHARGE

TO CAST HIS BALLOT IN SECRET, a man entering the booth closes the curtain by swinging the lever to the right. This also turns a crank disk, working two pitman arms (only one is shown below). Through bell cranks, the arms trigger a latch on each side, releasing a spring-mounted locking bar, which snaps up. (The bar runs through a slot in each of the metal straps connected to the selection-lever pointers and locks them until it is thus released.) Now the pointers are free, ready for voing. Ratchet teeth on the crank disk, with an ingentous pivoted pawl, prevent reversing the lever once you begin to move it. When the pawl slips past the last tooth, it is free to flip the other way for the return of the lever, as on the facing page.

TO RECORD HIS VOTE, a citizen swings down the pointer of his choice, ruising the strap connected to it. Bottom ends of straps hang between small rollers in a rigid channel, with stops at both sides. Enlarged end of strap, rising between two rollers, forces them aside, crowding all others so that no other strap in that group can be raised.

BARSON

Burg #



# Machine Works

states; in six they are mandatory at every polling place.

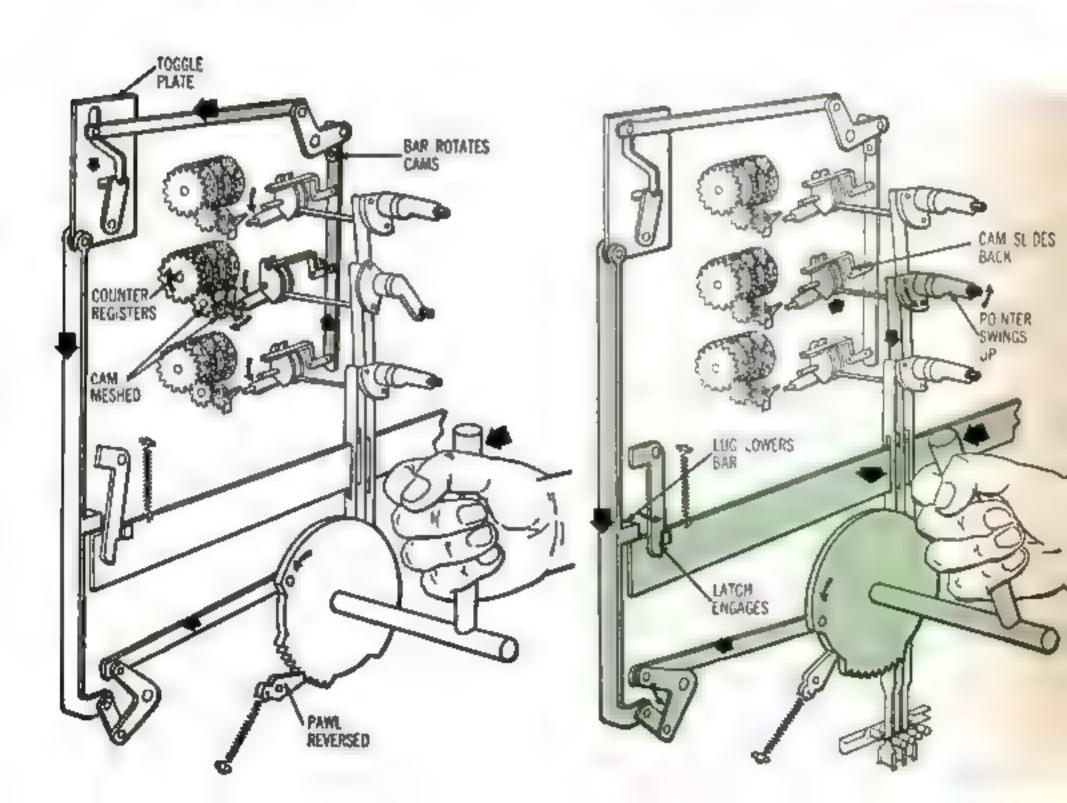
Though expensive (\$1,500 to \$1,800 each), machines pay by reducing election costs and eliminating expensive recounts. Another advantage is that they give quick returns after the polls close. They require little maintenance, last a long time, and,

some politicians believe, help draw voters to the polls.

Interlocks prevent pulling the lever for too many candidates, or voting both Yes and No on a question. A paper roll permits write-in votes. The mechanism shown is made by Rockwell Manufacturing's Automatic Voting Machine Division.

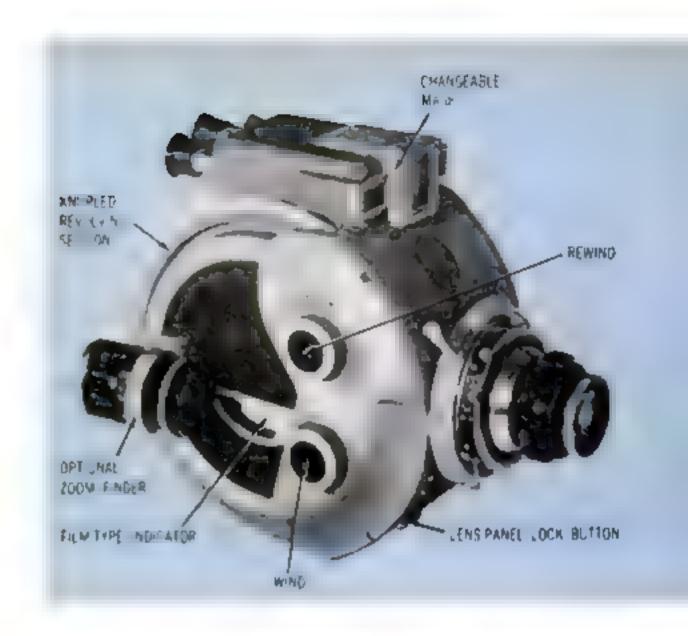
fo change his vote, the user need only flip back up a selected pointer and swing down another. But stops and rollers, previously set up, let him vote only for the right number of candidates (one mayor, four councilmen, for example). Swinging a pointer down slides its registry cam into engagement with a three-digit counter that totals the votes for that candidate. When he has made all his selections, the voter swings back the big handle, with the ratchet pawl now reversed (below). The crank disk and its linkage first pull down a toggle plate (top left below). Through a bell crank this rotates all pointer cams, but only those in mesh with counters register votes. Next, lugs pull down the locking bar as below at right. The bar pulls down the straps, flipping up all down-swing pointers, ready for the next voter. Finally the mechanism opens the curtain.







Color? Infrared? Fast-action? No fuss and fumble with extra cameras to match film to subject when you use the new-



# 3-in-1 Camera

#### By M. Robert Beasley

F YOUR shoulder is sagging under the weight of three or four cameras, hold on. Your burden's about to be lifted-and all those cumbersome straps, flaps, and separate lenses will merge into one consolidated whole, like the split image of a range finder. A new 35-mm. camera with one shutter serving three film chambers should hit the market by the first of the year.

By simply revolving the lens mount, you can switch from one type of film to another without tedious mid-roll rewind. Or, if you're sticking to one film while covering a wedding or family reunion, you can load all three chambers with it, for over 100 exposures without

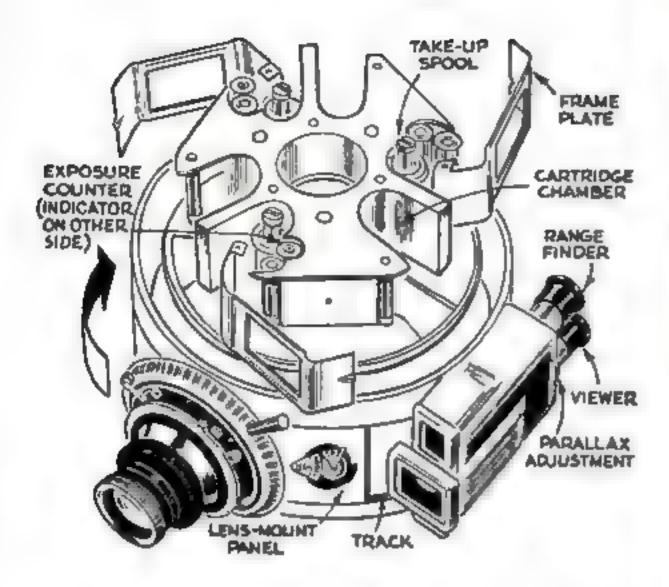
reloading

When 35-mm, cameras started to come into their own, film selection was no problem. You either chose color for twoby-two transparencies or black-and-white for enlarged prints. The versatility of these cameras, however, led to the introduction of an ever-greater variety of film stocks, so that today the 35-mm. enthusiast must choose from many types and speeds of film, both domestic and imported. The choice is often a painful compromise, since different subjects and conditions call for different films. The minute you load up with slow color, someone is sure to invite you to a rodeo in the rain.

The three-camera juggler. Sam Noble, the Detroit inventor of the Noble 3-35, was a nimble three-camera man when he served as an Army photographer. He decided that the lens and shutter components were the most expensive duplication and set out to fashion a camera whose multiple functions would have a single lens mount in common. After much trial-and-error, he developed the custommade model shown here.

The all-metal camera has more than 250 parts and weighs about four pounds. To change from one film chamber to another, you just disengage the bayonettype lock knobs marked "wind" and "rewind," Each chamber loads much like a conventional camera, and each has its own exposure counter.

Preventing mix-ups. Film in the "work-



ing" chamber is identified by an index label that appears at a window when the chamber is positioned behind the lens. Two of the chambers have permanent labels for the films you'll use most: daylight color and fine-grain black-and-white. The third has a selector disk listing other types (indoor color, infrared, high-speed black-and-white) so that you can dial the proper label when you load the chamber.

The camera has a Compur MX shutter with settings from one to 1/500 second, and bulb. A built-in split-image range finder is coupled to the 50-mm. f/2 lens. The viewer is designed to accept slip-in masks that adapt it to other lenses; it also

has a three-position parallax adjustment.

Telephoto and wide-angle lenses are optional equipment, and there's a clip on the body for a zoom-type viewer that spares you the trouble of changing masks. Also optional is a revolving turret for all three lenses to give you the versatility of nine cameras in one unit. A flash attachment extends the uses still further. The camera can be used in both vertical and horizontal positions. On the left side is a tripod socket; the thumbscrew of an L-shaped carrying handle also attaches to this.

The camera lacks a few refinements of the best 35-mm. equipment. For instance, there's nothing to prevent double exposures if you're the careless type. And the price—not yet established—will not be low. But it will probably still be cheaper than three separate cameras of comparable quality.



OPEN ONE CHAMBER by sliding back the curved lens-mount panel. Lift hinged frame plate, pull out rewind knob, drop cartridge into place, and push knob back to engage film spool. Draw out film leader and insert in take-up spool.



WHEN FILM IS DRAWN SNUO with two or three turns on take-up spool, drop frame plate back in position. Note wind and rewind knobs on right side and lens-mount track flanking film chamber. Tripod socket can be seen in top picture.

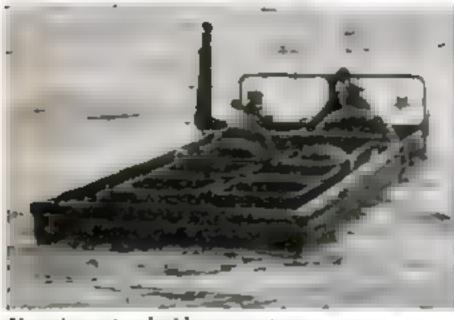


SNAP FRAME PLATE IN PLACE against film, and slide lens-mount panel up track to close the chamber and bring shutter into position in front of film. Advance two frames and set chamber's individual exposure counter on 1 for your first shot.



switch to ADJACENT CHAMBER by revolving knurled section of body toward you after releasing the wind and rewind knobs from their shafts with counterclockwise turn. When body clicks into next position, press knobs into new shafts.

#### PS PICTURE NEWS



New Army truck rides on water . . .

. . . or under it; it's all the same.

#### Floating or submersible trucks

A new series of amphibious trucks being developed by the Army are so snugly watertight that they can even be driven completely submerged. Contracts to design and build prototypes of the go-anywhere vehicles have been let to Ford, GMC, and Chrysler. Two or more will become standard equipment. One is a 31/2-ton, six-wheel-drive truck, the other

a five-ton, eight-wheel-drive monster. They will travel on mud, sand, brush, and water. Each is powered by a diesel engine that can be converted later to a variety of fuels, can be removed and replaced as a unit, and will run, stop, and restart while completely submerged. The prototype vehicles do up to six m.p.h. on water, 50 m.p.h. on land.

# My Most **Embarrassing**

**Shop Moment** 

"CLEAN the chimney now, with company

almost due?" my wife protested.
"No time before. Besides, I've got a new system figured out. Relax."

I wanted to make a log fire—our first of the season—after dinner, but had sworn I'd clean our soot-clogged chimney first.

With a plywood panel braced against the fireplace opening, I banged an old tire chain around from the top of the chimney. It worked fine. Removing the plywood revealed a mountain of feather-light black gook.

I wasn't going to sling that around. Instead I plugged in a powerful old vacuum cleaner I'd just bought to use around my workshop. I hitched on the hose, turned the switch. Silence.

"What's with the juice?" I yelled. "Iron blew a fuse," answered Ann.

Down in the cellar, I heard the doorbell. and Ann letting company in.

Hurriedly I screwed in a new fuse, Up-



stairs, the cleaner roared into action. When I got there, I walked into a room-sized cloud of soot and three charcoal-gray people.

I'd hitched the hose to the blower end of the cleaner. The nozzle, lying in the sootfilled fireplace, had done the rest.—J. Pullman, San Diego, Calif.

Do you have an embarrassing shop blunder that haunts you? PS will pay \$50 for each such experience published. None can be returned. Keep it brief, Address: Shop Editor, Popular Science Monthly, 356 Lexington Ave., New York 17, N. Y.



PICTURE-WINDOW STORM SASH

# Mechanics and Handicraft SECTION

VEATHERSTRIPPING . 1



# How to Winterize Your Home

A few simple jobs done now will seal your home snugly against the assaults of freezing weather

It's the little things you do that count when you button up your home against winter's blasts. The jobs are small, seldom costly, and often overlooked but they add up to big benefits in extra warmth, comfort, and fuel economy during the long cold months.

You wouldn't go through the winter with an open window, for instance, yet you're doing the same thing if your house isn't weatherstripped. The hundreds of feet of hairline cracks around your doors and windows add up to a whopping total area—big enough to equal a partly open window. The result if they're neglected: As much as 30 percent of your fuel dollars are gone with the wind.

Most of the weatherproofing methods shown on the following pages aren't costly or difficult. You can do a complete door or window in 15 min-



SOOT REMOVAL...150





AFTER CUTTING DADOES IN FRAME, slip inner horizontal members in place and lay out dadoes in them with a straightedge from frame dadoes as shown. This assures perfect alignment of the grid.



from bottom up to keep horizontals from sugging. Nail in outer retaining strips and paint before glazing. This leaves only inner strips to touch up after glass is in place.

LEDGES INSIDE THE GLASS provide 16 niches for displaying knickknacks, making the storm sash attractive as well as functional. Sash can be removed easily for cleaning the glass (see preceding page)



utes for as little as \$1. If you don't want to weatherstrip the entire house at one time, start with the doors and windows that are the loosest fitting and those that face prevailing winds.

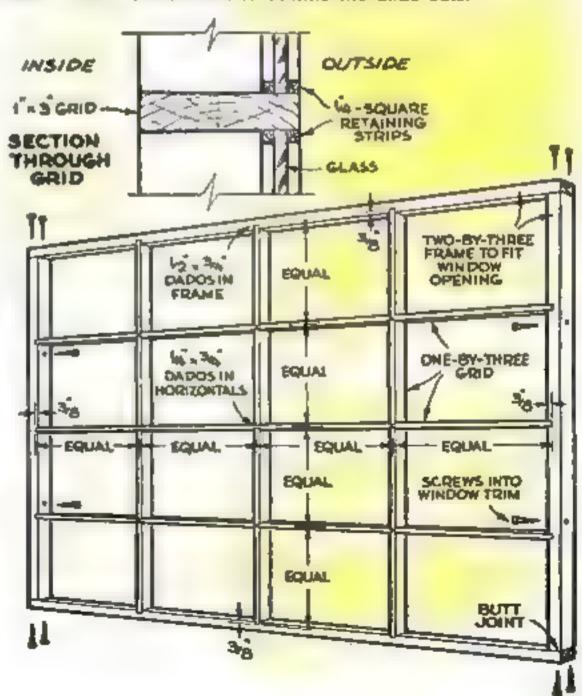
One of the most often neglected cold spots is the giant picture window in today's homes. Because of its size, it seldom has a storm window, yet it's this large expanse of glass—with its high heat loss that needs a storm sash most.

On this page is a new idea in picture-window protection. It's a storm sash that mounts *inside* the window. Made of small panes of ordinary glass, it can be built to fit any size window. For the summer, it can be slipped out quickly and stored, or you can leave it in place all year. Cost: a fraction that of commercially made storm sash. As a bonus, you get an attractive grid effect with shelves for decorative knick-knacks.

Sealing cracks with calking compound takes only a few minutes and is important protection against both wintertime leaks and springtime repairs. You'll find the latest news on proper calking techniques on the following pages.

Even insulation, usually a big job, can be done a bit at a time—for instance, added in small amounts to take the chill off an especially cold room. Rooms

TO DIVIDE TWO-BY-THREE FRAME into 16 equal parts, measure %" in at sides, top, and bottom, and from these marks divide each frame section into four equal spaces to locate centers of grid members. Measure %" on both sides of each centermark to outline the dade cuts.



above an unheated crawl space are frequently hard to keep warm. Stapling insulation batts up between the joists in the crawl space is a Saturday-afternoon job that will pay off promptly in more comfort and less fuel waste.

You can also save a remarkable amount of wasted heat by freeing your furnace and chimney flues of soot. It takes only a thin layer of soot to cut in half the heat your furnace puts out. You'll find the proof—and what to do about it—on page 150.

While you're checking the furnace, don't forget the little extras, such as draining the expansion tank, renewing warm-air filters, and bleeding radiators. A surprising number of unnecessary service calls come from home owners who have overlooked these simple chores.

The finned baseboard convectors popular today also require special attention. Dust on the fins can cut heat output to the point where the furnace won't carry the load. Remove the covers and give the fins a thorough vacuum-cleaning. Some hot-water heating systems also require switching over from a summer to winter setting on the domestic hot-water supply to provide adequate heat.

Increasing the moisture in the air may help you feel warmer and more comfortable during the winter. Check into the special humidifier attachments that can be added to warm-air furnaces. Some furnaces are already equipped with such units—without their owners knowing it. To tell if you have one, look for a water line running to the furnace.

Older humidifiers use absorbent plates to evaporate water from a pan. These plates must be replaced every three months or they become clogged and lose their effectiveness.

Newer humidifiers force moisture into the air by atomizing water or vaporizing it, instead of relying solely on evaporation. They are more expensive than platetype humidifiers, but supply more moisture. Such units can be added to any warm-air furnace, and you can install most of them yourself. Prices start at about \$50.

To be sure your home is adequately winterproofed before the cold winds start to blow, use the check list at right. Every check means more comfort in the home, more money in the bank.

### Winterizing Check List:

17 tips for warmth and comfort during the cold months to come

1. Shut off and drain outside aill cocks to prevent freeze-ups.  2. Check the roof for loose, curied, or worn shingles and replace them or cement them down with roofing tar.  3. Clean out gutters and downspouts to keep water from backing up and freezing under the roof, where it will cause leaks.  4. Batten down the TV antennatighten loose straps, replace frayed lead-in—and save an icy climb later.  5. Use flexible plastic sheet to seal windows not covered with storm sash.  6. Paint any screens that can't be removed, to prevent rusting.  7. Seal cracks with calking compound to keep out wind and water.  8. Draftproof doors and windows with weatherstripping.  9. Clean the furnace and chimney flues of heat-robbing soot.  10. Drain the expansion tank in hot-water systems before turning on the heat.  11. Clean or replace the filters in warm-air heating systems.  12. Bleed radiators or baseboard convectors to remove trapped air.  13. Switch over from summer to winter setting on your domestic hot-water supply.  14. Renew the plates in furnaces that are equipped with plate-type humidifiers.	during the cold months to come
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	that are equipped with plate-type

16. Lay in ashes or sand for slippery spots, and salt for melting ice.

the main supply of wood outdoors to

avoid termites.

15. Get firewood in early so it will be dry when the snow fires; but keep

17. Check weak fences or trees that might be blown down in high winds, and brace or guy them wherever this is necessary.

# Weatherstripping

New types do a better job of sealing out wind and water, and they go on faster and easier

THIS year's news in weatherstripping is spelled v-i-n-y-l. In half a dozen forms, vinyl plastic now gives you weatherstripping that's inexpensive vet durable and good-looking.

Earlier forms of felt or rubber—while still useful on some temporary, low-cost jobs—have their disadvantages. Felt tends to get out of shape, rubber to crumble or become sticky with age. Vinyl, however, holds its shape and is practically indestructible.

A trio of vinyl senis. For a quick job, there's vinyl tubing, sold in rolls, that you just tack in place. It's tight-fitting, but not as attractive as some other types. One of the neatest is vinyl foam bonded to wood strips. This looks like decorative molding and is virtually invisible when painted to match the woodwork.

Another trim-looking variety is a molded vinyl held in aluminum strips. A narrow version (13/16") is used on household doors, a wider one on garage doors. Price is about 35 cents a foot.

The vinyl inserts in these aluminum strips come in several shapes. A tubular one provides a tight fit against swinging doors and windows, but tends to stick a bit against sliding sash. Special slimfingered vinyl strips are made for sliding doors and windows where friction must

be kept to a minimum.

Sealing off with metal. Although metal weatherstripping is still widely used, it is somewhat trickier to install since it must be placed at the edge of a door or window instead of simply against the face. It is one of the best types for snugfitting double-hung windows because the metal allows the sash to slide easily. For doors, however, it's gradually giving way to surface-mounted vinyl strips.

Metal spring strips sometimes get out of shape or lose their seal if a loosefitting door or window shrinks away from them at the edges. Interlocking metal strips avoid this problem, but are harder to install. They consist of two U-shaped strips, one mounted on the door or window and the other on the jamb. Attached to the surface, they're fairly easy to install, but are conspicuous. The concealed type calls for rabbeting the door edge, but provides one of the neatest, most durable jobs you can get.

Block that draft. Door bottoms are the most critical points in weatherproofing Here you find the worst drafts and leaks and, at the same time, the heaviest wear on whatever material you install to stop

them.

If your present threshold is worn and uneven, you'll do best to put in a new one that has a vinyl insert. Most of these are aluminum, but this year they're offered in oak, too.

Where you already have a threshold in good shape, you can save money by adding a narrow vinyl-and-aluminum cap strip on top. This cap is made to work in two ways. If you prefer, you can fasten it to the bottom edge of the door instead of the threshold. This takes more workthe door must be removed to do it-but it makes the vinyl seal invisible and saves wear, of course, because you won't be walking on it.

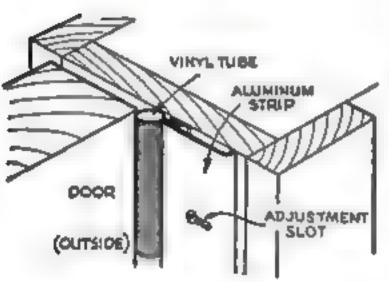
Turn back the tide. No door-bottom seal can be expected to stop a heavy flow of water by itself. An extra rain shield is required to divert wind-driven water. This is usually a separate strip of metal fastened to the outside of the door. It can be either thin sheet metal, which is cheap, or a sturdy aluminum extrusion,

### Five of the newer types of vinyl weatherstripping

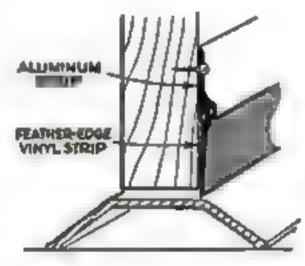


VINYL TUBING, held in a flexible aluminum strip, is cheap and fast to install. For door or window, it comes in 17' coils for about \$1.25. One drawback in some spots is its undisguised look.

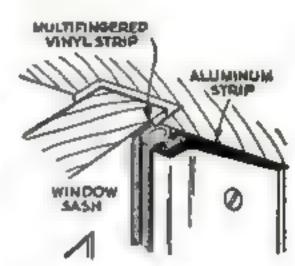
VINYL FOAM, bonded to wood strips, has the trum appearance of molding. It's simply tacked on with corners mitered. It costs a little more than vinyl tubing—about \$2 for a 17' kit.



RIGID ALUMINUM STRIPS with vinyl inserts are held on with screws through slotted holes. They look neat, have the advantage of permitting exact adjustment of pressure.

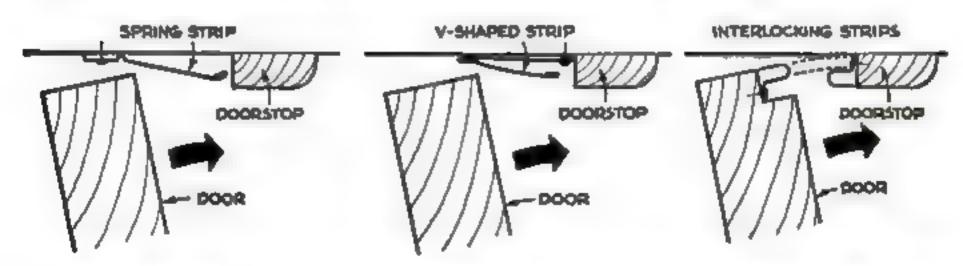


FEATHER-EDGE VINYL, also held in a rigid aluminum strip, tapers to a thin edge. It's ideal for sills and sliding doors or windows where friction must be held down to a minimum.



MULTIFINGERED VINYL, one of newest types, has thin edges for less friction but maximum weathertightness, It's good for sliding sash or where wind and rain are severe.

### Three types of metal seals for keeping out weather



METAL SPRING STRIP above at left is cheapest, but sometimes gets out of shape. V-shaped strip at center above is more durable, easier to install,

but more expensive. Interlocking strip at right is tricky to install, but provides a tough, longlasting, and weathertight seal. which is trimmer looking but a little more expensive.

You can also get a vinyl-and-aluminum door bottom that has a built-in rain shield. The whole thing goes on in one piece, and you don't have to remove the door to do it. It costs about \$2.

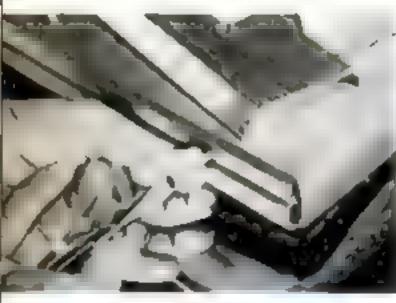
Dam out the flood. Doors that are exposed to wind-driven rain may require an interlocking threshold. This consists of a hook-shaped strip on the bottom of the door that engages another hook-shaped strip on the threshold. The interlocking strips require careful fitting, but once

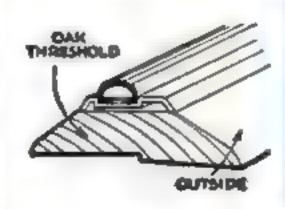
installed they are almost impenetrable.

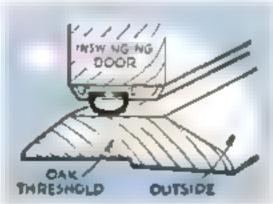
Another type of threshold has a rain drain built into it. Any water that gets past the seal is caught in a trough inside the door and is channeled back outside through holes. This type of threshold can be bought separately or used with other kinds of door-bottom seals.

One of the fanciest door bottoms is an automatic type that swings up when the door is opened to clear the carpet. As the door closes, the vinyl strip strikes stops on the door jamb and is pressed down against the threshold.

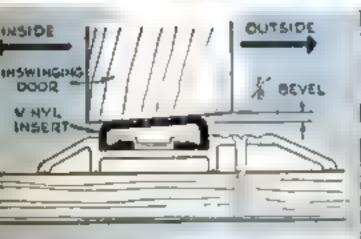
### Five ways to weatherseal the bottom of a door







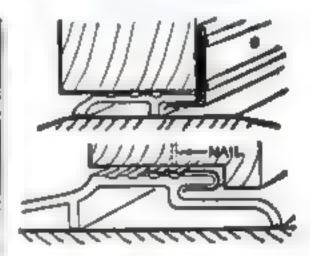
TWO-WAY DOOR SEAL fastens either to threshold, without removing door, or to the door bottom. Fastening to door takes more work, but conceals it and saves foot wear on it.



Atuminum Threshold replaces existing wood one that may be worn or loose-fitting. The tubular vmyl insert can be replaced with a new one later if it should become worn.



commention book notion has a vinyl seal and rain shield in one strip. It can be attached without removing the door, can be used with the existing threshold or put in with a new one.

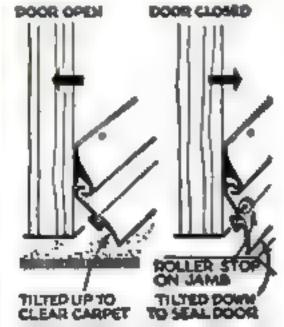


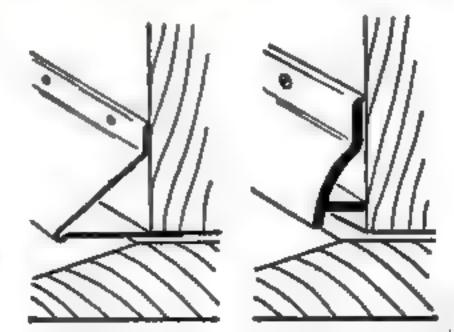
interlocking strips come in two kinds. Surface type at top is easy to install, but is exposed. Concealed type at bottom is neater, but requires rabbeting the door edge.

AUTOMATIC DOOR SOTTOM flips up as the door is opened to clear the earpet, then is pressed down tight against the threshold as the door swings closed against stops on the jamb.

RAIN SHIELDS keep water from running under the door, can be added to most door bottoms. Type at left requires removal of door to nail it on; one at right fastens to face of door.







## Calking

It's what you do before you seal the cracks that makes the job permanent—or botches it

ON'T cuss the calking compound if a crack opens and water or icy drafts find their way inside the house. Most calking failures are caused by poor preparation or technique. For a buttoning-up job that will last, keep these

four points in mind.

• A hairline crack that pulls water into the house by capillary action is too tiny to calk effectively. A bead of compound laid on the outside can easily pull away. It may even form a ledge that helps water get in. The best cure is to open the crack—cut it wider at the surface—to form a deep V in which the calking can get a grip.

It's not enough just to fill a gap.
 Overfill it. Then, if the calking shrinks, hardens, or crumbles, or if the joint moves, there'll be enough in the crack to

carry on the job.

 Don't rely on calking alone to pack wide or deep cracks. Provide a base by tamping the bottom of the crack full of



DEEP CRACKS should be packed with oakum or steel wool to provide a base for the calking and to set up a second barrier against weather. Small tube of compound shown is handy for single jobs. Key helps squeeze out the material.



WIDE CRACKS like this one in a wall are best filled with knife-grade calking or glazing compound. The material is stiff when applied, stays flexible after it sets. Wet the knife to keep the compound from sticking to the blade.



FOR RUN-OF-THE-MILL JOBS cartridges are quickest and cleanest. Half-harrel gun, in use here, takes only cartridge with plastic nozzle. Standard gun, on sill, houses no-nozzle cartridge, or can be filled with bulk compound.



FOR CALKING HOUSE WALLS, bulk compound can be colored to match. Stir in some house point or heavy-bodied stain until color is uniform. Thick material from bottom of paint can contains most pigment, wan t thin the compound.



FOR ROOF JOSS, a black asphalt-base compound as the thing to use. I nlike ordinary calking, it will stick to wet surfaces. You can patch the roof or seal leaky flashing while it's raining and you can readily see the leaks.

oakum—the tarred rope that plumbers use. Steel wool can be used if the calking job is not too large.

 Be sure you get good adhesion. Calking compounds won't stick to dirty or greasy surfaces, or dusty concrete. Wipe all areas to be calked with turpentine or paint thinner.

Most compounds won't take hold on wet surfaces, either, so work after a dry spell. The exception is asphalt-base compounds. They'll take to wet surfaces, letting you patch a leaky roof even when rain is falling.

Paint may grip calking securely at first, but when it peels, the compound goes with it. Scrape your way down to something solid for a lasting job.

Raw wood is the subtlest enemy of adhesion. Calking may seem to stick fine; then the wood sucks the oils out of it, leaving a dead, dry compound that can't ride out the movement of the wood. Prime raw wood with varnish, shellac, or house paint before calking.

Cold weather will interfere with good sticking by making the compound too stiff to flow. Try not to calk when the temperature falls below 40 degrees; if you must work, warm the compound to room temperature.

Which compound to use? There's a confusing variety of materials on the market, but, fortunately, each type will do several jobs.

For wide cracks or exposed places, a stiff compound is called for. Use glazing compound or, for a bit less stiffness, knife-grade calking. Both are too heavy for a gun and must be applied with a putty knife, a wood paddle, or your fingers. Wet the applicator to keep it from gumming.

Gun-grade calking will handle most jobs. It can be bought in cartridges, or in cans for hand loading.

The can type is cheapest, but you must invest several dollars in a gun. To keep the price low and make loading easy, it's best to buy it by the gallon. To load the gun, take off the cap, push the end of the barrel into the compound and draw back the plunger.

Bulk compound, usually gray, can be tinted to match the house color, making a neater job. This is not as important as it sounds, as calking should be painted anyway to keep it from drying out. There's also a bright aluminum color for calking around metal.

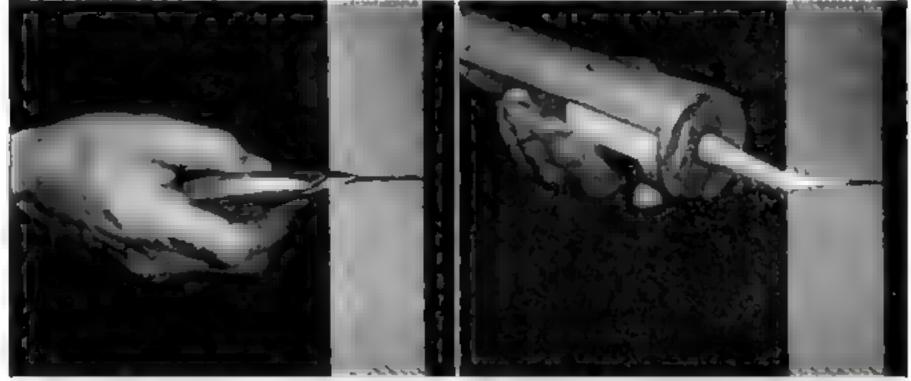
Using cartridges saves time and cuts your initial investment. You buy a single small container at a time, and there's no

### How to calk thin, deep cracks for a permanent seal



WRONG WAY: Compound applied (left) over a thin crack stays on the surface, penetrates only

slightly. If ealking or wood shrinks, a ledge is formed (right) to funnel water into crack.



RIGHT WAY: Widen the crack with a knife or chisel (left) to form a deep V. Then force calk-

ing well in, leaving some excess at the surface of the crack. This joint will remain tight.

loading or cleaning mess. Cartridge calking comes in shades of white and gray.

Calking also comes in dispenser tubes, like toothpaste, for small jobs. A key helps you squeeze it out.

Specialties for special jobs. Black calking for roofwork is basically plastic asphalt cement, sometimes with asbestos fibers added. It comes in cans and in cartridges. Use it around flashing or vent pipes, for sticking down shingles, and for patching small damage

To make an especially strong patch with the knife-applied type, spread a layer, press heavy cloth into it, and spread a second layer over the cloth. Dealers often stock asphalt-saturated cloth for such patches. Use black calking

only where its color won't matter. You can't paint over it—it bleeds right through the paint.

Cord-type calking, about as thick as clothesline, comes in rolls ready to use. Simply press it into a wide crack with your fingers. Less messy than paste calking, it is good for temporary or one-season jobs. It can, however, be shaped and inserted permanently.

Though technically not a calking compound, epoxy-resin mending material can be used to seal small areas. Mixed with its own catalyst, it can be worked into cracks with a paddle, sets in minutes, and becomes impervious to just about everything, including anything the weather can send you.

### 10 (0)

## Cleaning

A de-sooting job now can add to

If YOU heat with oil or coal, you can pay a high price for soot. It can cut the efficiency of your furnace by as much as half (see table). In the days of cheap fuel, our ancestors hired the chimney sweep to improve heating. Today, with soaring fuel costs, de-sooting pays off both in warm rooms and cold cash.

De-sooting your furnace is a dirty job, but it's not difficult. Do it now, before the cold winds blow, and you'll have a smoothly running heating plant all winter.

Soot is present in even the best of furnaces because combustion is never complete. Sooty smoke settles on the heat-exchanging surfaces and builds up layers of insulation that keep the heat from getting through to the air or water that warms your home. A furnace that operates at only 50-percent efficiency must be run twice as long to produce the same amount of heat.

Soot is a hazard, too. It can cause fires in your chimney that may spread to the house. And it can so foul up your stack control that the switch may fail to shut down your furnace in an emergency.

Before you start the job, let the fur-



GORS OF SOOT like this steal heat, are a fire hazard. Tap metal flue pipes sharply with a stick to loosen the soot; scoop it out through the damper opening or clean-out door.

nace cool down for several hours. And for safety, switch it off—so it can't start up while you're working on it.

Scrape the furnace walls. You can reach the heat-exchanging surfaces above



LOOSE JOINT around the blast tube of an oil burner allows cold air to be sucked in, which reduces combustion and causes soot. Seal any cracks with refractory furnace cement.



DIRTY Oil FILTER feeds sludge to the burner, causing a sooty flame. Clean the filter—found in the pump, as here, or in the line—and the burner nozzle with carburetor cleaner.

## Chimney Flues

your comfort and safety-and slash fuel bills, too



SCRAPE FURNACE WALLS on the inside with a long-handled wire brush to dislodge soot. It's not necessary to remove the particles—they fall to the bottom and will be burned away.

the combustion chamber with a longhandled wire brush poked through the door at the front. Scrape off the black scale down to bare metal.

To clean the metal stack outside the

REMOVE THE STACK CONTROL from the side of the flue and wire-brush the tube. Then dip an old toothbrush in solvent and very carefully clean the bimetal strips inside the tube.

furnace, rap the sides of the pipes smartly with a stick. The soot will break loose and fall to the bottom where you can scoop it out through the clean-out door or damper opening



cuean out the chimney with a bag of gravel on a line dropped from the top. Move the bag up and down and sideways so it rubs the walls, dislodging the soot. Seal up open fireplaces



first as above, at left, to keep the soot from blowing out. Tack cardboard to a light wood frame and wedge it tightly into the opening with strips of wet cloth around the edges.

The stack switch needs delicate handling. The bimetal element that extends into the stack must be slipped out carefully, and the strips gently cleaned with a soft brush and solvent. Never use a wire brush on them.

Clean the chimney, too. This needn't be done as often as the furnace—every five to six years will do. Easiest way to

**How Soot Can** 

Cost You Heat

HEAT

LOSS\*

90% 260%

45%

69%

AMOUNT

OF SOOT

1/32" thick

1/16" thick

1/8" thick

3/16" thick

surface.

\*Based on 100% ef-

ficiency of a clean

inspect the chimney is to angle a mirror beneath it so you can see upward.

If you spot thick, black, rough-looking deposits, it's time for a cleaning. Besides being a fire hazard, the scale acts as insulation. The extra heat normally given off to the house on the way up the chimney keeps right on going out the top. Heavy soot deposits can also reduce the flue opening enough to cut down the draft, which causes a dirty fire—which causes more soot deposits.

You can make your own chimney sweeper from a burlap bag partly filled with gravel. Tie the bag to a rope and lower it down the chimney so that it rubs against the walls, knocking the soot loose. If the scale is very stubborn, it can be chipped off with a log studded with nails, raised and lowered like the bag.



CHECK WARM-AIR REGISTERS: If you find soot on the insides, it may be a tip-off to leaks in the furnace that let smoke enter the air supply. Have a servicemen check the furnace.

Chemical soot removers. These do a fair job, but are no substitute for a thorough cleaning by hand. They're useful on furnaces where heat-exchanging surfaces are hard to reach with a brush.

There are a number on the market. One kind, for oil-fired furnaces, is added to the fuel tank and works in much the same way as additives sold for cleaning

carbon deposits from auto engines. Another kind, for coal- or wood-burning furnaces, is a powder you sprinkle on top of the fire.

When using the oil additive, pour the chemical into your fuel tank just before the truck comes to fill it. This insures thorough mixing with the oil. The powder stuff raises the temperature inside the furnace. If you use it on a furnace of the automatic type with a bimetal control, remove the control temporarily to prevent damage from excessive

heat. Seal the hole left by the control by wiring on a scrap of sheet metal.

Stop excess soot. Some soot is inevitable; a lot isn't. You can keep it to a minimum by making sure that your furnace is properly adjusted.

The likeliest cause of soot is a poorly regulated air supply that produces a smoky fire. Introduce just enough air to make the fire burn cleanly, but no more—too much air blows heat out the chimney.

The air control on oil burners is usually a sliding collar that covers slotted openings in the burner housing. By loosening the collar and moving it to one side or the other, you open or close the slots to let in more, or less, air. Take care to make the adjustments slowly and gradually. A too-sudden or extreme movement of the collar may throw combustion out of whack and give you confusing results.

Other causes of soot are air leaks around an oil-burner blast tube, a dirty oil filter, and a clogged burner nozzle. Cleaning the filter and sealing up leaks are jobs you can do yourself. If you don't wish to remove the burner to clean the nozzle, it's worth having a serviceman do it after other trouble spots have been checked.



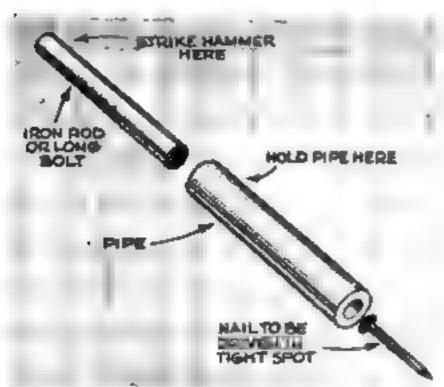


### Ship Canal from an Old Tire

Cur a discarded tire in half along the tread center with a keyhole or compass saw to make an endless canal for your youngster's boats. Putty any nailholes below the water line.— John J. Bahr, Ithaca, N.Y.

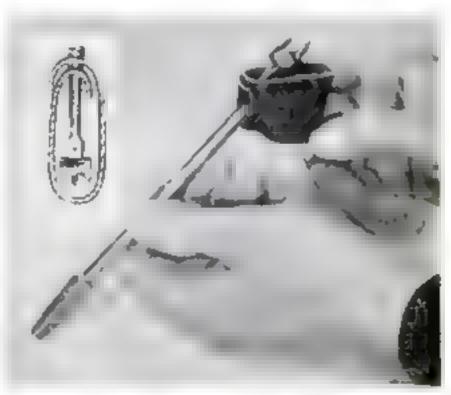
MY VALUABLE old barleycorn bottle was ideal for a den lamp, but was such an odd shape I couldn't drill it in any of the usual ways. I took it to the local garage and asked to use the plug-cleaning machine. With the bottom of the bottle held tight against the blast gasket, the abrasive compound cut through the glass, leaving a smoothly tapered hole for the wire.—R. B. Ryan, Torrance, Calif.

AFTER you've welded a protective layer of stainless steel over mild steel, you may want to grind it down to a smooth surface. To be sure you aren't removing the overlay you just applied, check by coating the smoothed surface with copper sulphate (CuSO<sub>4</sub>). Any mild steel you've exposed will discolor or "blush." Stainless won't.—Lloyd Mc-Williams, Shawinigan South, Que.



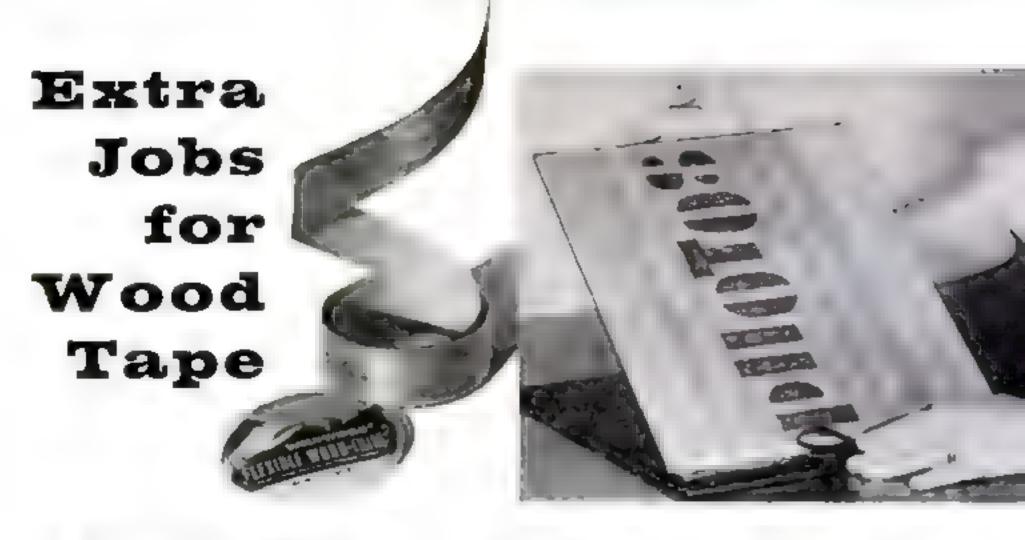
### Improvised Nailing Gun

There's almost no spot too tight for this simple nailing tool. Measure the distance from the clear area (where you can swing a hammer) to the spot where you must drive the nail. Cut a piece of pipe enough longer than this to provide a hand grip at the top. Find a piece of rod that will just slip inside the pipe. Insert the nail at the opposite end and drive it by striking the rod.—Charles Andres, Port Sulphur, La.



### Guard for Expansive Bit

A starp from an old inner tube will protect your expansive bit from damage in the tool box. Cut the strip wide enough to cover the extended blade. Overlap the ends of the strip and punch a hole through the two lapped ends. Slip the square end of the shank through the holes and then pull the loop over the blade. To use the bit, pull the guard to one side and up the shaft—but leave it attached.—R. Hanscom, Elmhurst, Ill.



### By Edwin M. Love

You're missing something if you reach for veneer tape only when you've got the edges of a plywood panel to finish off. This versatile material can be used in many imaginative ways, opening up woodworking fields that you may have shied away from.

Inlaying, for instance. Try it with tape. The kind called Flexible Wood-Trim comes in coiled strips 1" wide and 8' or 16' long, and in different woods that permit many striking combinations.

Here are two sample projects. Both call for a backing of \(^1/6"\) tempered hard-board cut \(^1/6"\) longer and wider than the pattern to allow for fitting the strips together. Tools required are scissors and a brush for the white polyvinyl glue. Dunk the brush in water after each use.

Gameboard. Scribe center lines on the hardboard and lay out the squares. Each requires two strips and you'll save time if you make the cutting jig, below. Apply the first strip to a square at the center of the layout, lining up an edge and an end with the center lines. Rub flat and add

14 x 1 12 x 13 2 50 45

CUTTING JIG FOR CHECKERBOARD STRIPS
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the second strip, keeping the center-line end even with that of the first strip while closing the edge joint. Assemble the other three center squares and trim the outer edges with a chisel, as shown below, right. Lift the waste from the board and scrape off the surplus glue before removing the straightedge

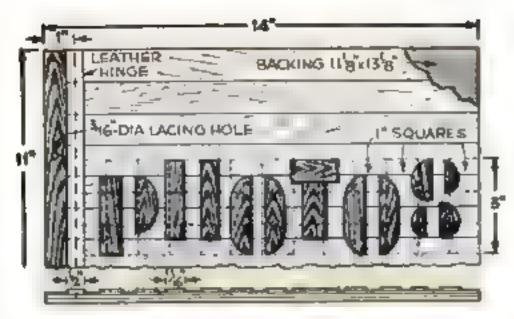
Against this core of four squares, build the surrounding rows, trimming each. When the playing area is complete, miter and apply border strips. You'll have to trim the tape for the narrower ones.

Photo album. The back is one piece of hardboard but the front cover is cut 1" shorter and filled out with a binding

### Inlaying is a cut-and-paste job,



JIG SPEEDS CUTTING of strips for the checkerboard squares. Nail three pieces of scrap together, as shown in the sketch at left, to provide a square corner for end of tape. Keep the lower blade of the seissors flat against the forward edge of the jig to assure a 90-degree cut.

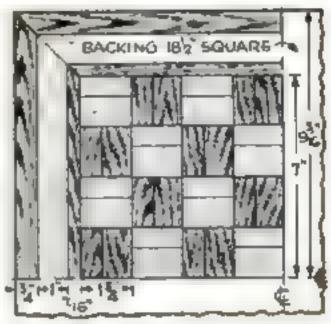


VENEERED ALBUM COVER has decorative overlay of letters cut from darker tape. Position these by making full-size pattern on graph squares and transferring this onto the background.

strip drilled to take a lace passed through the perforations in the filler pages. Scribe a center line and work in both directions from it when applying the tape strips.

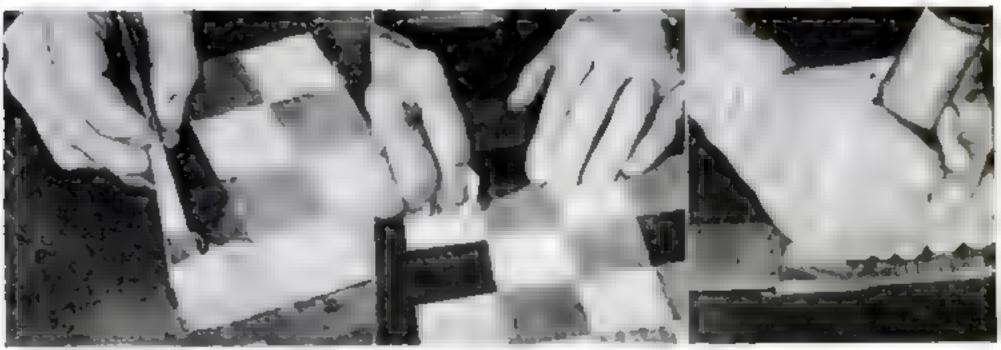
The overlay letters are 2½" tall and are cut from darker tape trimmed to a width of ½". Make four cardboard templates for the curved parts: half an O and the curved P and S segments. To position the letters, make a full-size layout on 1" graph paper and transfer this to the background veneer. Attach the finished cover to the binding strip with a strap of kid leather centered over the joint. Cut the strap wider than ½" and trim the edges straight after it's glued on.





is easy to lay out on hardboard backing. One quarter is shown here. Birch and walnut squares provide a good contrast.

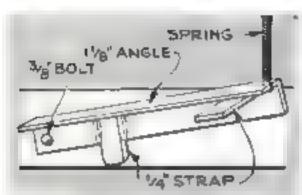
### yet the effect is entirely professional



APPLY WHITE GLUE with a soft "" brush after moistening the hardboard backing and wiping with a cloth. When surface is tacky, press strips in place. Work only one square at a time. RUB COMPLETED SQUARE with a cloth to work out air bubbles and excess glue. Wipe away glue beads that appear at joints and scrape off excess squeezed out around the edges.

TRIM SQUARES by drawing the corner of a sharp chisel along the edge of a steel square clamped to the face of the work. It's usually best to cut veneer pieces a bit oversize.





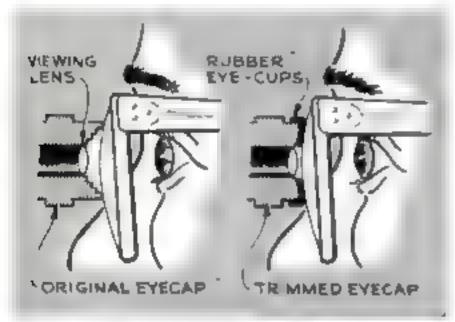
### Loosening a Stuck Garage Door

MANY overhead garage doors stick at the bottom, especially if they freeze shut in winter. Stepping on this foot lever will jack up the door and let you open it

easily. It's made by welding two short pieces of 1/4" strap iron—one for a foot pedal, one for a fulcrum—to a 14" length

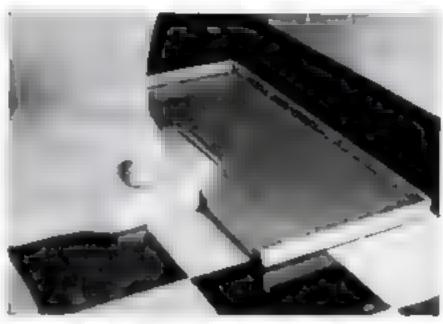


of angle iron. A spring holds the pivoted lever out of the way when it's not in use.—James Rouse, Danville, Ill.



### **Adapt Binoculars to Eyeglasses**

Most binoculars are awkward for people who wear glasses. Projecting flanges on the eyecaps butt against the spectacles and keep the eyes too far from the binoculars for an adequate field of vision and proper focus. As a Park Ranger, I found it a bother to remove my glasses each time I had to use my 7x50 binoculars; by trimming off the flanges, I increased the viewing area, when wearing glasses, by about 50 percent. Plastic eyecaps can be removed and hacksawed, filed, or ground down to the shape shown. To avoid scratching spectacles and to keep out stray light, slip on a pair of soft-rubber eye-cups, available in camera stores.-Robert C. Stevens, Zion National Park, Utah.



### Drip Pan for Flush Tank

BATHROOM condensation causes our toilet tank to sweat badly. We cut a cardboard template to fit behind the toilet and added a 3/4" flange when we transferred this pattern to sheet aluminum. After cutting and bending, we sealed the corners with metal putty.—William Horrell, Louisville, Ky.

HEAT can't warp my slides and make them pop out of focus any more. I found that normal slide ventilation was obstructed by the adaptor for my automatic changer. Drilling six 1/4" holes in both the top and bottom of the adaptor restored regular ventilation.—Dr. George Kafig, Silver Spring, Md.

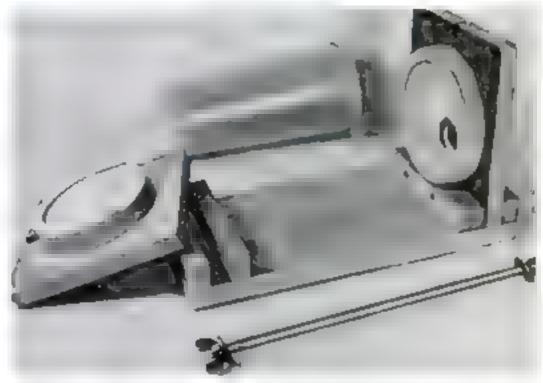
# ...Lathe Tumbler Speeds Finishing

You can give small stampings, castings, or machined parts a professional-looking finish with this homemade tumbler for your lathe. Stampings and machined parts can be de-burred, sharp edges knocked off, and surfaces given either a polished or matte finish. Imbedded sand can be cleaned from castings and fins, or other surface roughnesses smoothed.

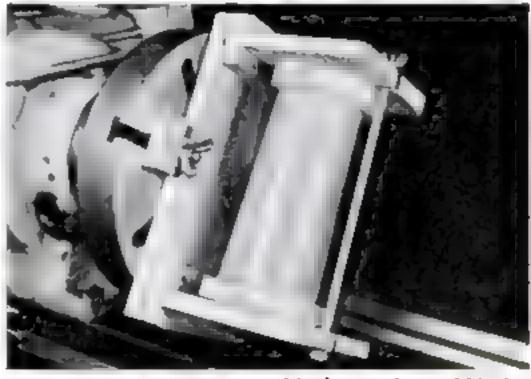
The tumbler barrel is an ordinary quart-size plastic shaker for powdered milk. It is supported in the lathe by a simple wooden frame clamped to the faceplate. The shaker nests in circular turned seats between the end supports, secured by a single tie rod with wingnut that clamps it tightly in place.

Techniques for using the tumbler will vary with the type of work and finish desired. Put the parts and abrasive in the shaker—don't overfill, about <sup>2</sup>, full is good—and run the lathe at fairly low speed, not over 200 r.p.m. Pellets specially made for the purpose are available from abrasives manufacturers. They come in various sizes and shapes to suit different jobs and finishes.

Use a fine abrasive for polishing, and experiment with the addition of a cushioning material such as sawdust, or water mixed with a detergent.—H. J. Gerber, Stillwater, Okla.



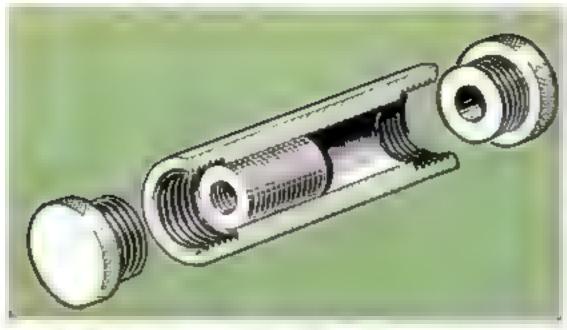
TUMBLER FRAME is made in three pieces: a backboard with two pairs of cleats, and upper and lower support boards for the shaker ends. Screw upper end support to cleats, leave the lower one free for easy removal.



**SNUG-FITTING RECESSES**, turned in the wooden end blocks, grip the ends of the plastic shaker. A single tie rod through slots in outside edge of end supports holds the whole assembly securely when the wingnut is tightened.



ROUND ABRASIVE PELLETS were used here to de-burr small stampings. Other shaped pellets are available for different kinds of work. On a job with inside corners, for example, you might use triangular-shaped pellets.



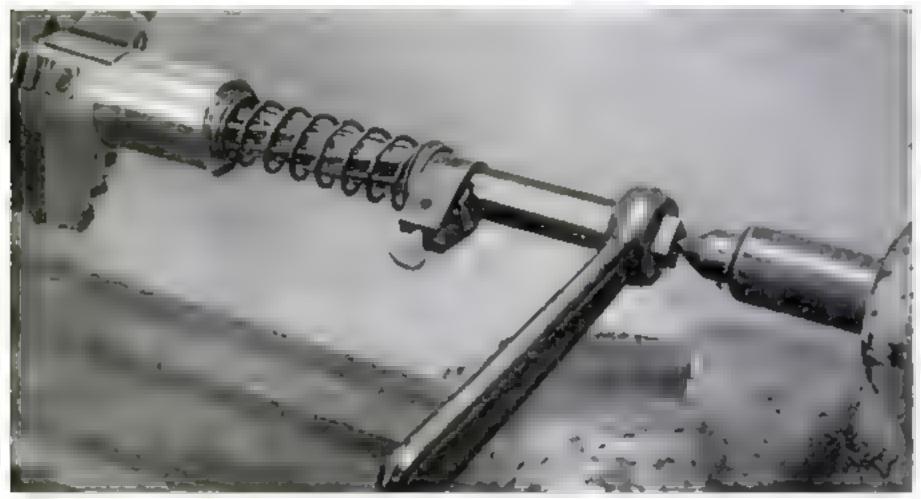
### Jig Simplifies Drilling Washers

When you need to enlarge the hole in fairly large quantities of washers, the job can be done rapidly on the lathe with this inexpensive jig.

Use a scrap of pipe with an i.d. that fits the o.d. of the washers. Thread the inside of each end. Make a stopper to screw in one end and use a standard drill bushing in the other. Fill the pipe with washers and screw the bushing in tight. The washers will be squeezed in a solid grip—securely held for drilling. Chuck the jig in the lathe and drill through all the washers in one operation. —Federico Strasser, Santiago, Chule.



When there's no room to turn a tap wrench, a nut pressed on the shank of the tap will let you choose any kind of wrench that will work. Use a hex nut that is a press fit on the square shank of the tap. Press it on with the jaws of a vise. Now you can use a socket, open-end, or box wrench to turn the tap.—William Harrell, Louisville, Ky.



### Take the Risk out of Power Reaming

REAMING under power is usually risky because of the tendency of the reamer to overfeed. A broken reamer or spoiled work often results when the reamer pulls off the supporting tail center, cocks to one side, and catches in the work. This jig will prevent such accidents.

Use a compression spring that fits

loosely over the flutes of the reamer. Lock a thumbscrew-type hose clamp on the shank of the reamer to back up the spring. Now, when the reamer is fed in with the tail spindle, the spring bears on the work's outer face and keeps the reamer seated tightly against the tail center.—H. J. Gerber, Stillwater, Okla.

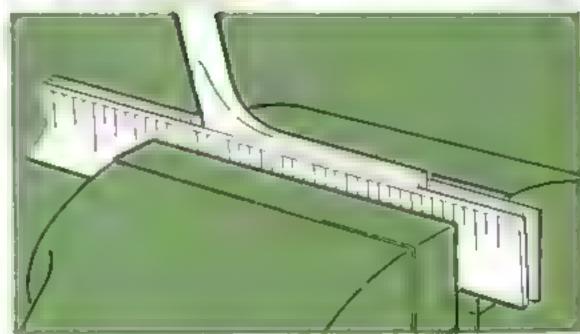
### How to "Coin" Your Own Rule

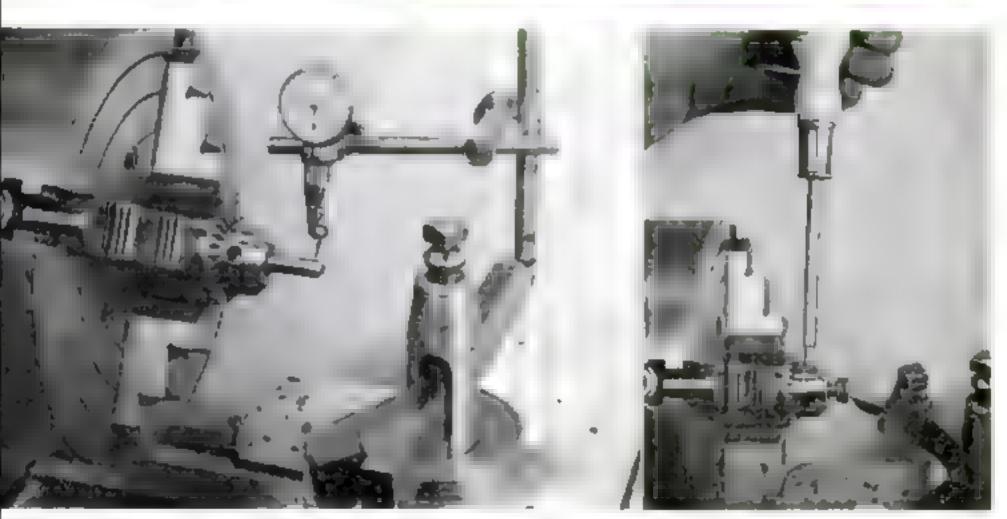
OFTEN a measurement is needed in a hard to-get-at place where none of your metal rules will fit. You can make an accurate replica of your engraved steel rule from a piece of wire solder and shape it to fit.

Bend the solder to the approximate shape you need and flatten it slightly with a hammer. Put the flattened part between two steel rules, with the solder protruding slightly beyond the edges of the rules. Clamp this sendwich in a copper-jawed vise and tighten.

The solder will take an impression of the markings on the rule. Trim the edges and file smooth.—H. Carhart, Ft. Lauderdale, Fla.







### **Chuck Small Work with Precision**

HERE's a way to handle small-diameter work more quickly and accurately than with a conventional chuck, even if you don't have collets for your lathe. Chuck a drill chuck in any ordinary independent-jaw lathe chuck and adjust it so that it runs dead true. This is easy to do with precision: Grip a short piece of drill rod

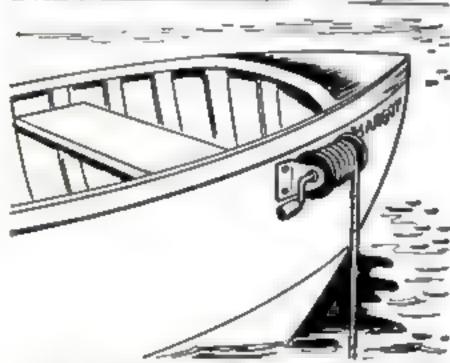
in the small chuck and check with a dial indicator as you make adjustments on the large chuck.

Make a "quick closer" lever for the drill chuck by grinding down the sawed-off end of an old screwdriver to fit one of the keyholes in the drill chuck.—H. J. Gerber, Stillwater, Okla.

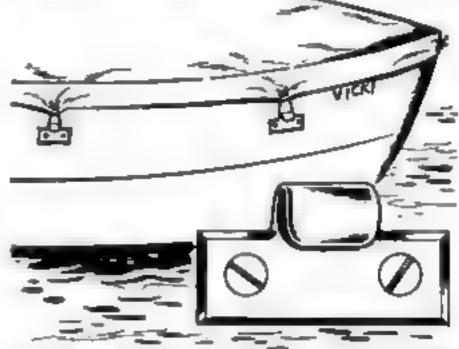
## Boating Tips

INNER-TUBE SOAT will let you fish those choice spots you can't reach from shore. Lay two slats across a used truck tube (size 11.00 x 20) and place a seat plank on top, at right angles, to form an H. Squat aboard and maneuver the boat with a paddle in each hand. It will carry more than 200 pounds safely.

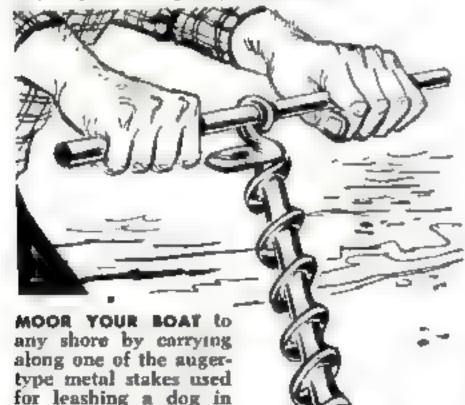


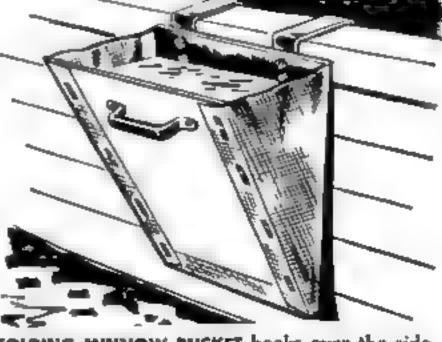


RAISE AN ANCHOR easily and neatly by means of a clothesline reel mounted on the outside of your boat. Inboard mounting is also possible if you provide a pulley for the line.



SASH LIFTS make inexpensive tie-down hooks for the cords of a boat cover. They can be obtained in brass or chrome to match the boat trim. Attach with sustproof screws or boits.





FOLDING MINNOW BUCKET hooks over the side of the boat, takes no floor space, and flattens for easy storage when emptied. Front and back are marine plywood or tempered hardboard with sash pull and aluminum-bar hooks bolted on. Join these two panels with canvas sides and bottom hinge, using waterproof glue. Evaporation through the canvas keeps the water cool.

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the yard. It will turn

by hand into a sandy

beach: in earth, you'll

want to put a stick

through the eye.



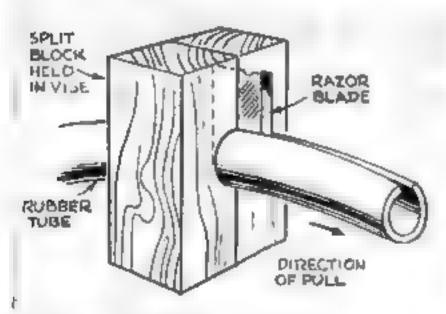
### **Barrel with Litter Appeal**

A DIAGONALLY cut section of one 55-gallon drum welded to the top of another makes an angled trash barrel with litter appeal. Although it takes three drums to make two angled ones, this type receptacle is used by motorists who'll drive right by conventional trash barrels.—

Arnold Gesterfield, Scottsbluff, Neb.

To DETECT invisible cracks, dip clean metal parts in kerosene containing a small amount of oil. Wipe dry and spray with a mixture of alcohol and zinc oxide. Cracks will show up as brown lines.—

Edward Bentley, Jackson, Mich.

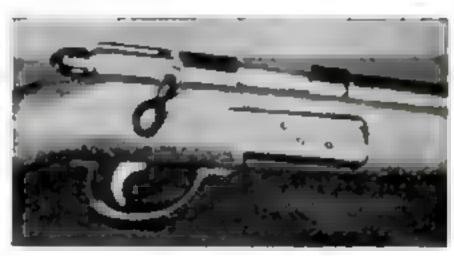


### **Slitting Rubber Tubing**

Russer molding for sheet-metal edges can be made by slitting one side of a small-diameter rubber tube. Pull the tubing through a hole drilled in a split block holding a razor blade as shown. If it's handy, a tube-flaring tool can be used instead of the split wood block. Be sure the razor blade projects into the rubber tube only far enough to cut the one side.—

E. R. Speakman, Venice, Cal.

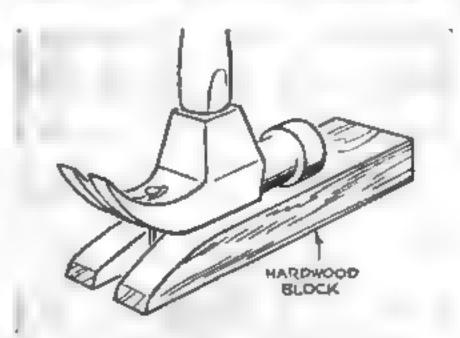




### Magazine for a Single-Shot

Carridges for a single-shot rifle can be quickly removed from a magazine on the side of the forearm. Cement a pistol or rifle magazine to a shim contoured to fit the rifle stock. Best position is with bullets pointing downward, opening toward the muzzle. Practice makes loading fast.—C. G. Syker, Newton, In.

THE WHEELS of my boy's bicycle ran crookedly—and I had no nipple wrench to adjust the spokes. But I did have a glass cutter—and one of the notches in it was just the right size to fit the spoke nipples.—Einer W. Antonson, Duluth, Minn.



### Slotted Block for Nail Pulling

NAILS can be pulled easier, and without bending, if a slotted, wedge-shaped block is used instead of the usual solid one. As the nail is withdrawn the slotted block is slipped farther under the hammer head for a straight upward pull. For best results and durability, the slotted block should be slightly curved, as shown above, and cut from hardwood.—Burton L. Wollenzien, Grand Junction, Col.

## Wordless Workshop

By Roy Doty and Rosa Lee Beeland

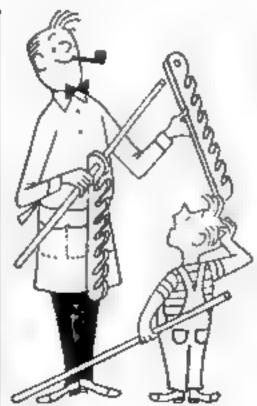


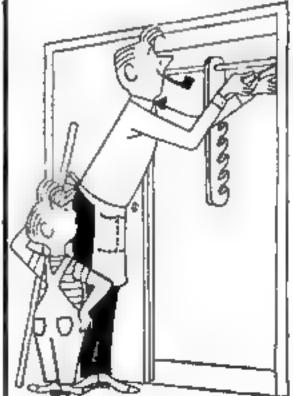


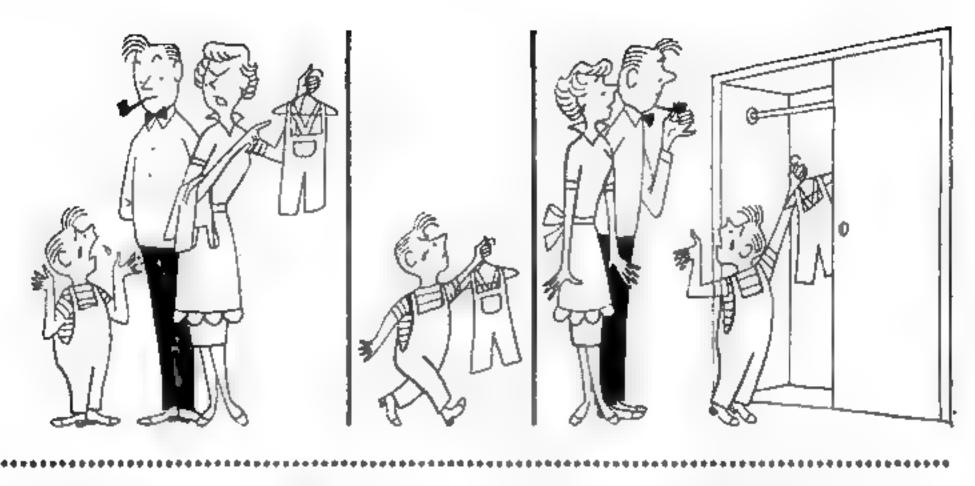


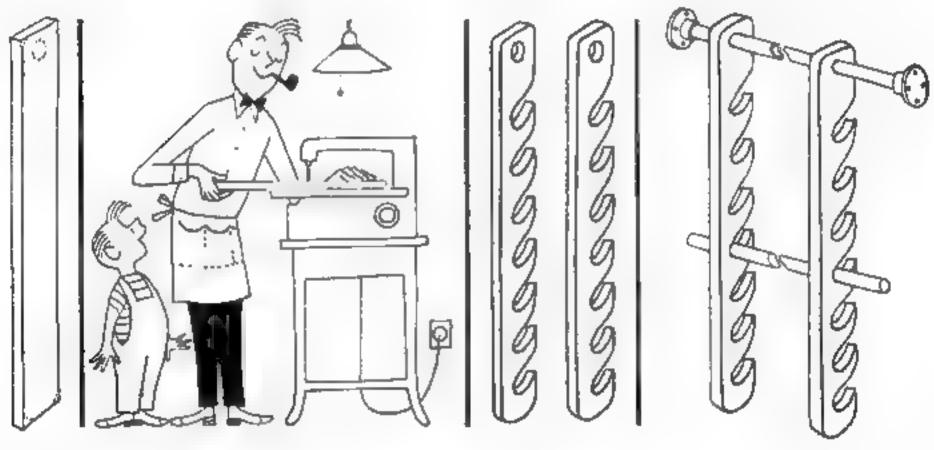


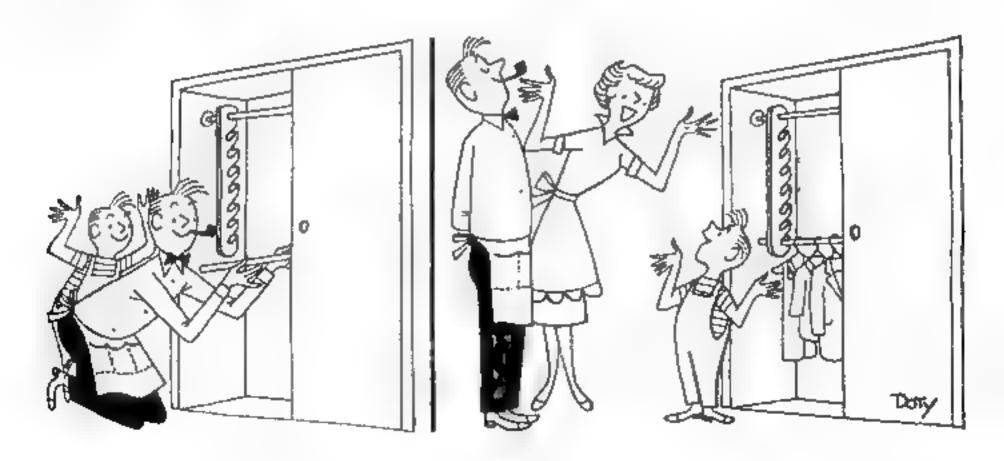


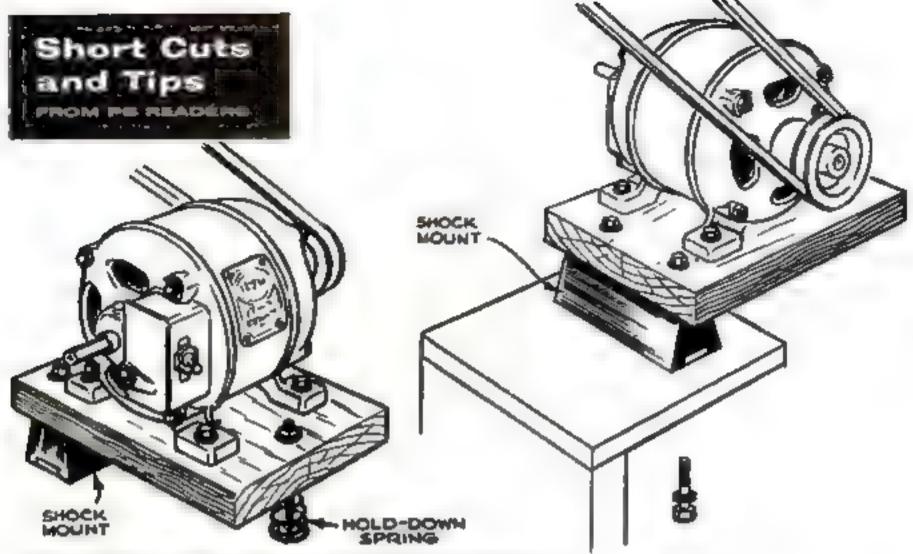








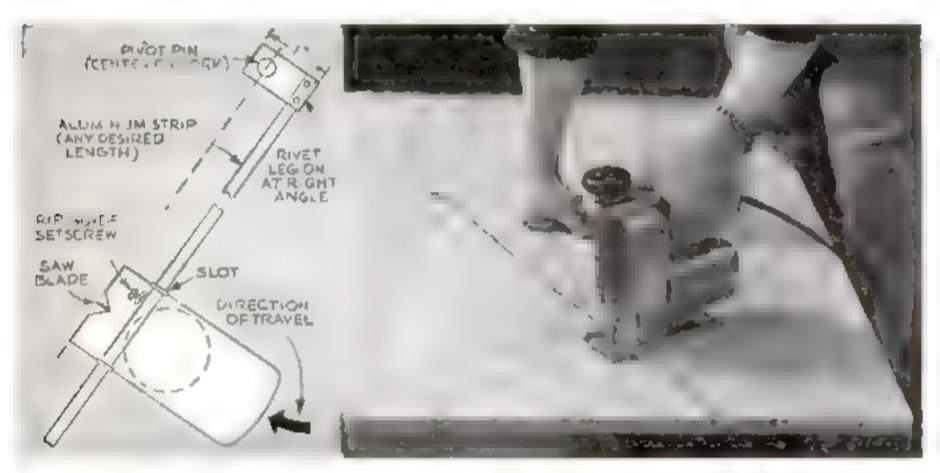




### **Utility Motor Mount Cuts Down Vibration**

Discarded automobile-engine mounts make flexible but sturdy supports for electric motors in the shop. A mount used at the transmission end of a three-point suspension system consists of a block of rubber with metal bonded to two sides. Such a mount, placed under one end of

the wooden platform to which a 1/4-hp. motor is bolted, will let the motor weight keep the belt taut. For heavier motors, a compression spring installed under the outboard end of the board will take some weight off the belt and help dampen vibration.—Don Engdahl, Santa Rosa, Calif.



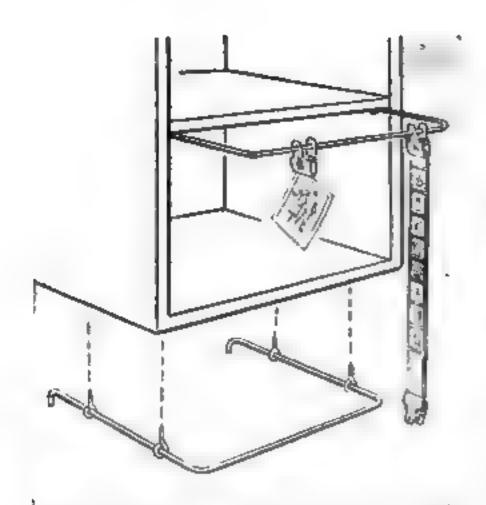
### Radius Bar Guides Saber Saw

AN ALUMINUM bar about 1/2" thick, locked in the slots normally used for the saber saw's rip-guide attachment, will swing the saw in a perfect arc for cutting circles. Pivot the offset end of the guide

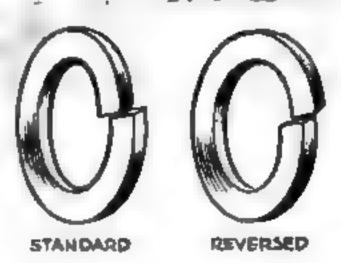
bar on a pin set in a hole drilled in the center of the circle.

You may find that some saw blades have too much lead, or tendency to run off the line, so experiment with different blades until you find one that cuts true.

—Carlton G. Bucher, White Plains, N.Y.







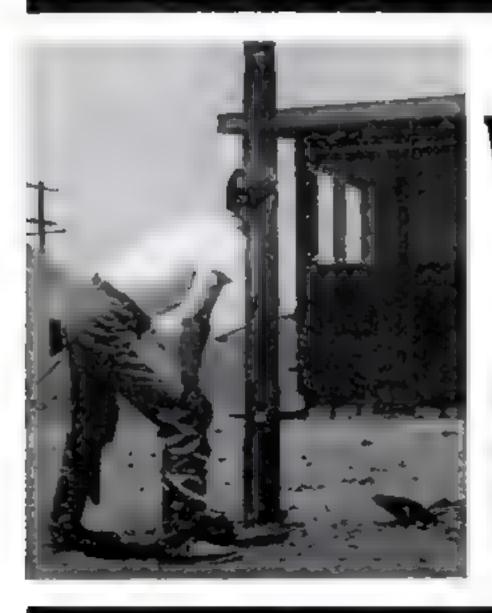
### Retractable Film Racks

Short of space in your darkroom? Mounted on the underside of shelves and work tables, these wire drying racks push out of the way when not in use. Shape heavy wire into a U (the size depending on where it's to be attached) and feed this into four screw-eyes spaced to take it. Bend down a ½" stop at each end. —D. O. Van Gilder, Denver.

### Left-Hand Lock Washer

AT THE hardware store, they thought it was a variation on the monkey-wrench gag, but I really needed a left-hand lock washer. The standard type tends to loosen a nut with left-hand threads; the torque is tensioned against the nut in the wrong direction. I reversed a standard right-hand washer with a twist in the vise.—

Robert A. Brown, Shelbyville, Tenn.



## What Would You Do

set and no level or plumb bob at hand

You might very well work out something with a string and a weight. But there's a quicker system.

Just sight along the post and a known plumb line, for instance the corner of a nearby house. Even a power pole is fairly dependable if there's no better vertical to check against.

Darrell Huff, Pacific Grove, Calif.

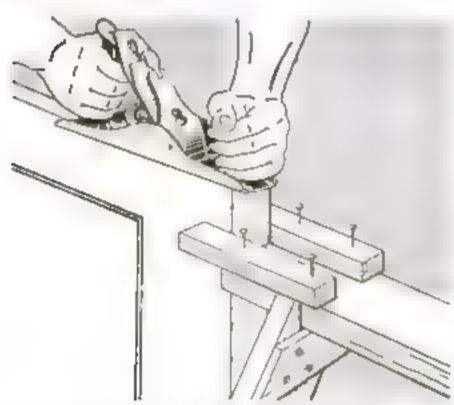
## Short Cuts and Tips



### Mount Switch in Plastic Box

A PLASTIC box of the type used to package small hardware items makes a neat housing for a low-voltage electrical switch. The surface mounting requires no cutting into the wall. Bolt the switch to the base of the box and drill holes through one side for the connecting wires. Attach the hinged lid to the wall at an inconspicuous spot, using small screws.

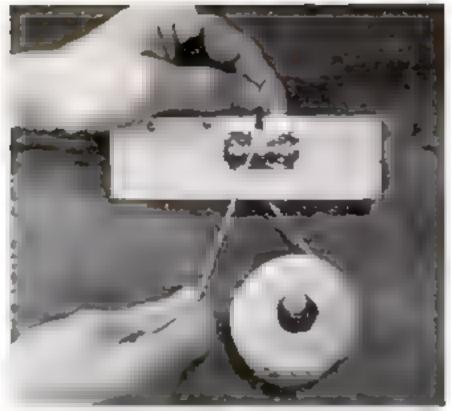
Access to the switch is easy-simply a matter of springing the catch and pivoting the box on its hinges. I found this mounting useful in wiring up a hi-fi speaker-selection system in various rooms throughout my house.—Carlton Bucher, White Plans, N. Y.



### Sawhorse Jig for Planing Doors

Planing door edges is easier if you wedge the door between two pieces of scrap nailed to the top of a sawhorse. Back the sawhorse against a wall.—

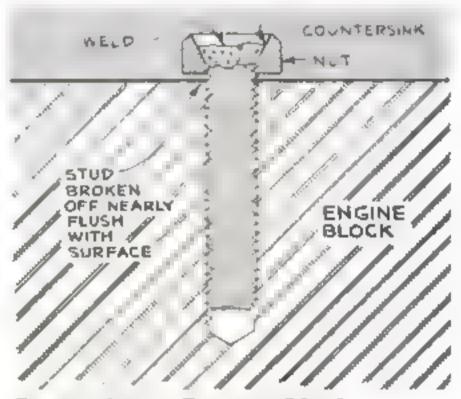
Daniel Bousha, Jackson, Mich.



### Razor-Blade String Cutter

Make a simple string cutter for the shop by attaching a single- or double-edge razor blade to acrap plywood with cellophane tape. The cutting edge should project a little above the bottom of a notch cut in the plywood to protect the fingers. Mount the unit on a spacer block, near a peg for the ball of string.

PPP CUTTING sheet aluminum with a jigor coping-saw is easier and faster if you first score the pattern with a scriber. To score straight lines, draw a linoleum knife along a straightedge. This also minimizes binding and breakage of blades.—Norman E. Nelson, Milicaukee.



### Removing a Frozen Stud

When the head breaks off a stud you're trying to remove, you can often weld on a nut. Countersink the top for easier access to the joint and a more secure weld.—Don Huss, Tiffin, Ohio,



The horizontal-sweep circuit is about the hardest-working part of your TV set. Not only does it paint, electronically, the horizontal lines on the screen, but it also makes the high voltage for the picture tube (in partnership with the high-voltage-rectifier tube). The 10,000 to 20,000 valts produced slam the electrons in the picture tube against the phosphor-coated screen to give light.

In most sets, the horizontal-output tube will have to be replaced more aften than any other tube. But take care. One of the case histories that follows will show you what I mean.

### By Art Margolis

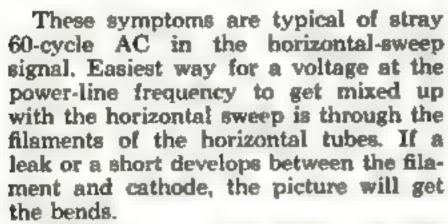
OUR local eye doctor, Dr. Cain Price, was "helping" me adjust his TV set. "No, no, Art—back the other way," he said in that overly patient tone one might use on a backward child.

The repair had been simple enough, His seven-year-old console had a classic case of horizontal bends. Depending on the strength of the channel, the picture distortion varied from a slight to an extreme S curve that made the performers look like hula dancers.

### Faulty tubes in the horizontal-sweep circuit



**SCREEN IS DARK** but sound is okay. Check these tubes by substitution in orders horizontal oscillator, horizontal output, high-voltage rectifier, damper and low-voltage rectifier.



When I replaced the horizontal-oscillator and -output tubes, the bends vanished. The electronic part of the service call was easy; with a little adjustment of the size and linearity controls, I could have been on my way in five minutes. But the doctor, as an expert on matters visual, had assumed command of the adjusting operation.

After a solid 15 minutes of turning the controls back and forth while he peered at the picture through his trifocals, it seemed that I was still no closer to satisfying the critical professional eye. I switched tactics.

After making sure the picture was adjusted to my satisfaction, I said, "Now, Doc, I am going to turn real, real, slow. You stop me when I've got it right on the nose."

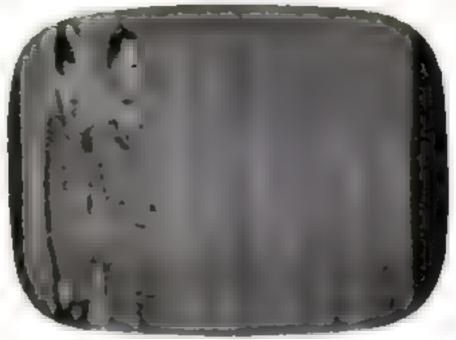
I reached behind the set, but didn't touch the control. "How's that, Doc?" I asked.

"Almost, Art. Almost," he said.

Still not touching a thing, I asked, "How about that?"

"Another hair, Art, just a hair."

I steadied my wrist with my other



HORIZONTAL SHRINKING, often due to aged horizontal tubes or low-voltage rectifier. Adjust the width control. Replace horizontal oscillator, output, and low-voltage rectifier.

hand but still moved nothing. "Well?" I whispered.

"That's it," he snapped, "Hold it. A perfect picture. Don't touch it."

### The Costliest Tube Change

FLO, the druggist's wife, sounded a little desperate over the phone: "Art, would you please come over? Joe doesn't know I'm calling, so sort of drop in."

Joe is an independent cuss and the most avid do-it-yourselfer in town. And "yourself" is not just a figure of speech.

They live upstairs over their store. I rang and Joe called from a window, his tone belligerent: "What do you want?" "Joe, can I use your phone?"

He calmed down and called hospitably,

"Oh, sure, Art, come on up."

When I walked in I saw the TV through an archway. A pile of TV tubes and cartons were strewn about. I recognized the brand as that from the self-service tube-tester display in his store.

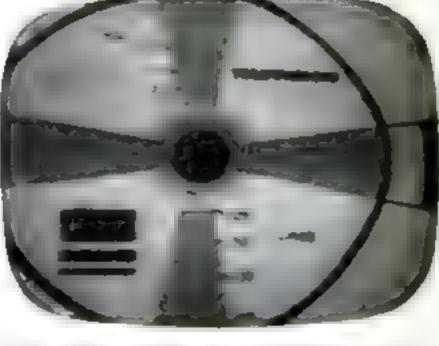
I ignored the TV, sat down at the phone, and dialed my shop. I knew no-body was there. Out of the corner of my eye I counted 10 6BQ6 horizontal-out-put tubes. Joe was putting in one \$4.35 tube after another and watching his money burn up. He had fallen into a familiar booby trap.

Here's what happens: The horizontal tubes—oscillator and output amplifier—work together to manufacture the electromagnetic force that sweeps the electron

### of your set can cause any of these troubles



CHRISTMAS-TREE EFFECT often accompanied by a singing or hissing noise from unside the set. Change horizontal-phase-detector or oscillator tube, adjust horizontal-phase control.



TOO MUCH WIDTH AND NONLINEAR SWEEP, Adjusting width and horizontal-linearity controls usually fixes thin. If not, try changing the horizontal tubes and high-voltage rectifier.

stream in the picture tube back and forth across the screen. The resulting horizontal lines must be drawn at the rate of 15,750 lines per second. The oscillator generates the required 15,750-cycle signal and the output amplifier beefs it up until it is strong enough to sweep the electron beam across the full width of the tube face.

But the output tube is all muscle and no brains. Like a spooked horse without a rider, it'll run itself to death if the oscillator quits. It is utterly dependent on the oscillator to keep it from drawing more current than it can take safely.

This was what booby-trapped Joe. When he saw the output tube glowing cherry red, he had correctly assumed that it was defective. But he didn't know about the role of the oscillator. Being the stubborn sort, he kept on putting in output tubes and burning them up. First thing he should have done was check the oscillator tube before putting in a new output tube.

Still sitting at Joe's phone, I made like I was talking to a customer while my shop phone rang unanswered.

"Yes, Mr. Smith, you say your 6BQ6 tube keeps burning up and you've already replaced three of them."

Joe didn't look at me, but his ears seemed to bend. I continued, "That's an old familiar symptom, Mr. Smith. Replace the 6CG7 oscillator tube and you'll stop burning up the 'BQ6s."

When I turned around, Joe was gone,

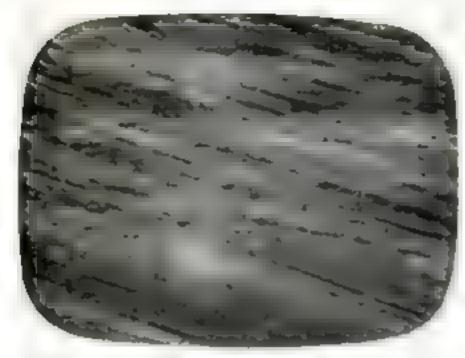


**BLOOMING** is expansion of the picture when the brightness is turned up. It is caused by lowered high voltage. Try replacing high-voltage-rectifier tube and horizontal-output tube.



BARKHAUSEN OSCILLATION. This shows up on the screen as one or more vertical beady lines. It is caused by unwanted oscillation of the horizontal-output tube. Try a new tube.

### These faults, too, are usually cured by new horizontal tubes



MORIZONTAL SWEEP completely off frequency (mixed pattern of mainly diagonal lines). Adjust horizontal hold, change horizontal-oscillator and/or horizontal-phase-detector tubes.



HORIZONTAL PULL, caused by filament-tocathode leakage in one or more horizontal-circuit tubes. Change horizontal-oscillator, horizontal-output, or horizontal-phase-detector tubes.

but I heard a clatter on the stairs to the store. I winked at Flo. Joe was back in a flash. Trying to be casual he crumpled a carton from a 6CG7 in his hand and let it drop to the floor as he reached into the set with his other hand.

I said good-bye to my imaginary customer and walked to the archway. "Thanks for the phone, Joe."

He had plugged in the set and was twisting dials. The picture came in crisp and bright. "Any time, Art, any time," he said absent-mindedly. Arms folded, he was looking triumphantly at Flo.

### The Wife Who Couldn't See Trouble

HENNY TOWNES is married to a sweet gal. Her only flaw, in Henny's eyes, is that she is a militant teetotaler. However, she usually observes an unspoken truce on his apple-cider nips.

The threatened collapse of this truce brought me a service call from Greta.

"Art, come over and settle an argument. Henny insists there's something wrong with the TV but I can't see any trouble. He's been drinking too much."

Amused, yet uneasy about walking into a family argument, I hurried over.

The floorboards creaked and groaned under me as I followed Greta into the living room. Henny sat in front of the TV, glass in hand and a pitcher of cider beside him. The TV was shining brightly.

"You won't believe it," he said, "but the TV was dark till you two came through the door." Greta gave me a what-did-I-tell-you look, I shrugged.

I sat down and absent-mindedly accepted the cider Henny offered. Too late I realized I wasn't helping the domestic crisis. Greta stamped out of the room.

"Hey, Art, look," Henny said excitedly. Then he yelled, "Greta, c'mere."

The screen had gone black, I turned to see Greta's face as she came in.

"Well?" she said. I looked back at the TV. It was shining again.

As Greta stamped out, I saw it happen. The horizontal sweep collapsed into one vertical white line in the center of the screen and disappeared.

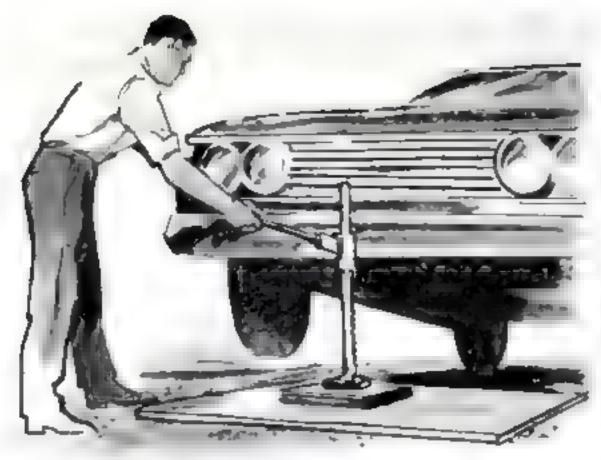
I knew what was happening. The horizontal oscillator was quitting intermittently. High voltage in modern sets is made from a by-product of the horizontal sweep. No horizontal sweep—no high voltage. No high voltage—no brightness.

I removed the back and plugged in my cheater cord. By tapping the horizontal oscillator, I could make the picture come and go. Loose tube elements were shorting intermittently. Evidently a loose floorboard was jostling the set enough to do this when anyone stepped in the room

I wanted to restore family harmony with a demonstration. I called, "Greta, would you come in again, please."

"What for, to chase pink elephants for you two sots?" she answered, angrily.

I've never claimed any talent as a domestic-relations counselor. I replaced the offending tube and got out fast.





### Jacked-Up Car for Awkward Glue Job

LACKING a clamp to hold a block in the center of a large panel of plywood while the glue set, I slipped the panel under my car, placed the bumper jack on the block, and left the car jacked up overnight.—Roland Laguer, Baytown, Tex.

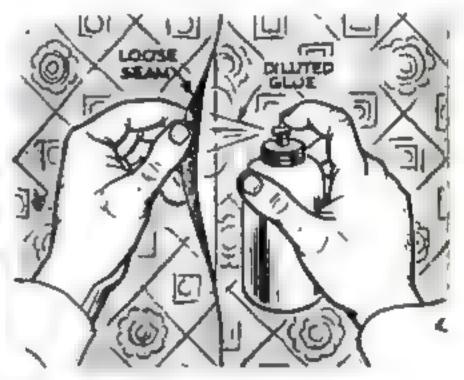


### Paper-Clip Nail Holder

It's clumsy—and risky—to hold small nails or brads in the fingers for driving. Unbend the outside loop of a paper clip to serve as a handle and insert the nail beneath the inner end. Once the nail is started, pull the clip free and finish driving.—Wayne Floyd, Fayetteville, Tenn.

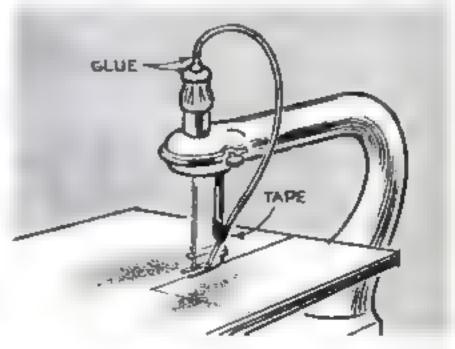
### **Dust Blower for Jigsaw**

Since my jigsaw wasn't equipped with a blower, sawdust kept hiding the line to be cut. I could feel an air current from the top end of the reciprocating-piston shaft when the blade was in motion, so I put this to work. I capped the shaft with a rubber crutch tip that had been vented to take the nozzle from a plastic glue dispenser. I fastened one end of a piece of plastic tubing to the nozzle and taped the other end to the guide shaft to direct the air toward the saw blade. —V. R. Nicholas, Kokomo, Ind.



### Regluing Wallpaper Seams

Brushing paste into loosened wallpaper seams often results in torn or stretched paper. Instead, dilute white plastic glue with an equal amount of water and use a window-cleaner bottle to spray a coat on the back of the overlapping sheet.—Ken Murray, Colon, Mich.







## Work-Horse Box

It's a workbench . . . It's a sawhorse . . . It's a tool box

### By Ernest E. Hickman

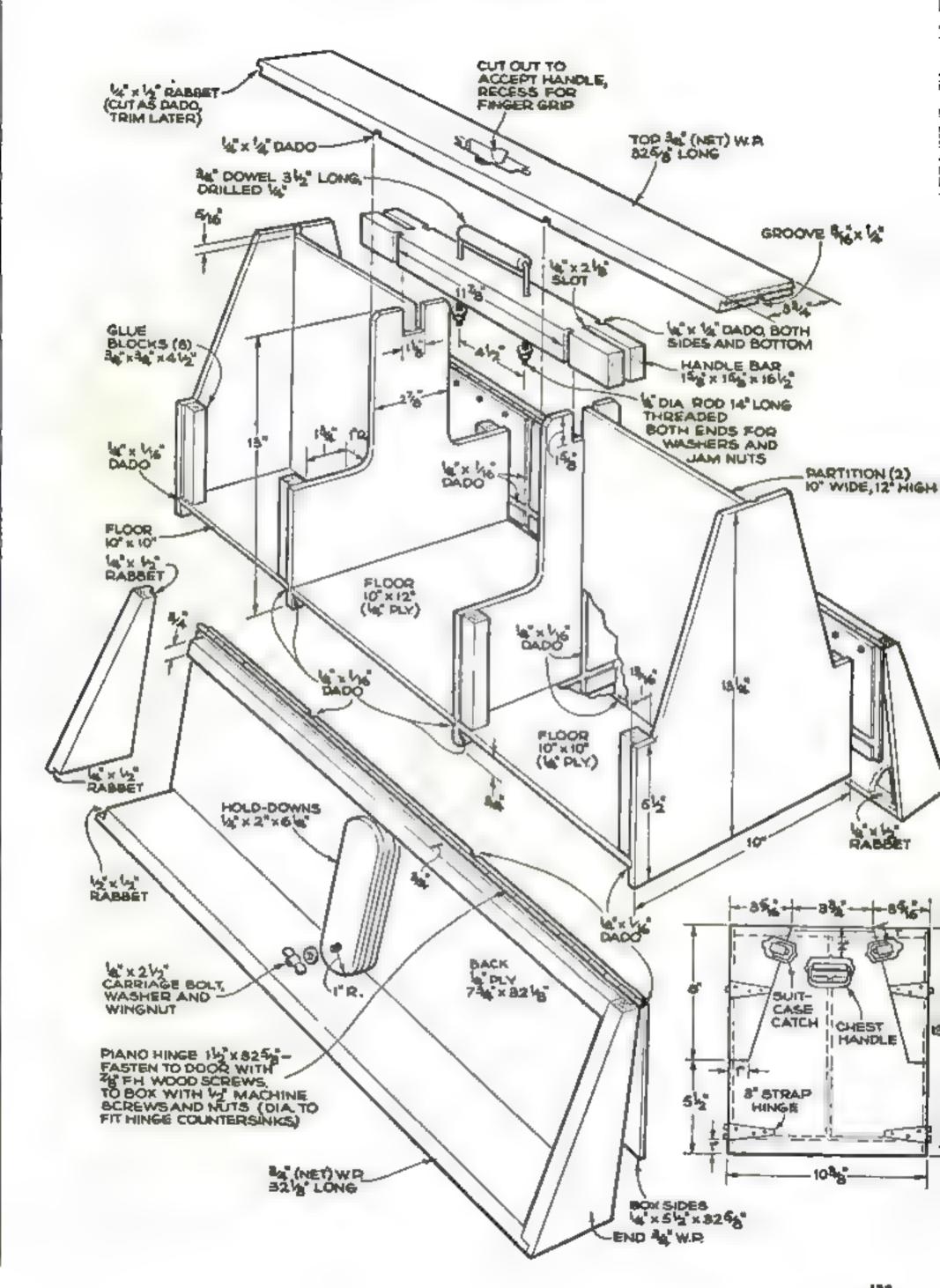
If YOU'VE ever needed your tools where they weren't, you'll appreciate this work-horse box. No ordinary tool chest, this one is ideal for toting some or all of your tools upstairs, downstairs, or over the hills to Grandma's house. That's because it

- · Holds all the tools you can lift.
- Racks them for protected travel.
- Spreads its feet to become a low sawhorse.
- Serves as a miniature workbench with a built-in planing stop (the retractable handle).
- Is just the right height for standing on to reach the ceiling.
  - Is sturdy enough to support one



with its FLAPS DOWN—and locked—the tool box functions as an off-the-floor work-hench (above, left) or a knee-high saw-horse (above) for hand or power tools It also makes a sturdy utility stool (bellow—or a support for a scaffold.

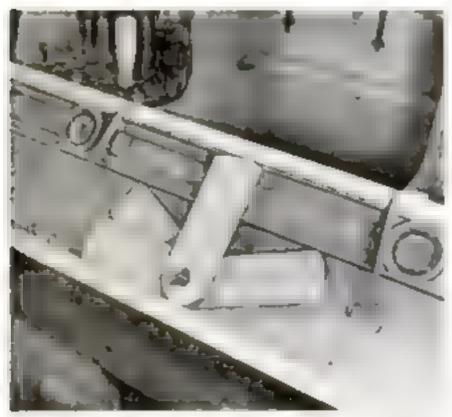






UNDERSIDE OF TOP is grooved to take partitions which are also set into dadoes and slots in the handle bar. The center hole lets the handle pass

through and is provided, on top, with rasped notches. These let your fingers grip and lift the handle for carrying the box to the job.



STACK OF PLYWOOD LEAVES pivoting on boilt inside the door adapts to hold different sizes and shapes. One leaf swings over a tool, others against it, a wingout clamps the leaves tight.

COIL-SPRING STRAPS are modified ironing-boardcover fasteners stretched between screw-eyes. They strap objects to the inside of the door or, looped around them, clasp them tightly.

The high strength and low weight come from using a light material—1/4" plywood—in frameless, stressed-skin con-

end of a plank scaffold bearing two men.

plywood—in frameless, stressed-skin construction. The pieces interlock, the edge of each gripped by a dado in its mate. The 1/16" dadoes are shallow enough to preserve the plywood's strength, but deep enough to provide a good grip when the pieces are joined with glue.

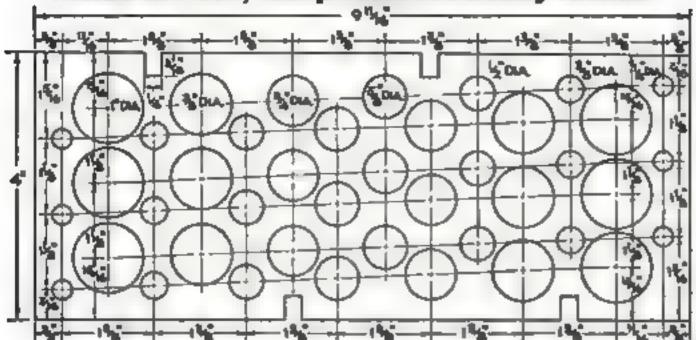
If a dado head or router isn't available for making these grooves, you can substitute strips of small molding, glued and nailed along butt joints.

For strong joints, the plywood should have clean, square edges; use a hollow-ground or special plywood blade in a table saw to cut out the parts. Cut the plywood partitions and ends before swapping the blade for a dado head. By grooving and dadoing these pieces while they're still rectangles, you'll be able to make all the grooves with only two settings of the rip fence. Only the short vertical grooves in the side pieces require use of the miter gauge.

Putting the box together. This is easier if you make the top and side pieces over-length. That way, you can cut dadoes instead of rabbets at the ends; these will help lock the parts in place while you glue them together. You can trim the surplus after the glue sets.

First glue the lengthwise partitions into the dadoes of both end pieces of the three-piece floor. To each resulting T-shaped section, add an end piece and a cross partition. Small brads through the joints will help keep the parts aligned while you clamp them. Put the

Inside the box, sharp tools are neatly racked



LAY OUT PATTERN for 42 holes in six ranks on the 44"-plywood top panel. Brad this to two more blanks and hore all three simultaneously, using drills graduated from 4" to 1". Glue notched posts in place. Rack prevents nicked chiscle and duiled drills.

center panel of the floor between the two end sections and draw anug with bar clamps.

Locate the vertical dadoes on the side piece by holding them against this assembly. After cutting, add these sides, then the handle and top, and you have a lightweight tool box. You can quit here if that's all you want.

Doors that become legs. For more than a box, add the fold-down doors. To secure them when lowered, make two pairs of hasps from small strap hinges. Remove the hinge pins, screw the hinge halves in place, and insert a nail as a locking pin.

Screws for attaching the hinges, suitcase catches, and other hardware should be sized to fit the countersinks. Flathead 6-32 machine screws with flat washers and hex nuts, and #6-1/6" flathead wood screws were used in the original. They're small, but show no sign of weakening after months of use. The chest handles are optional. I added them to the ends to make the box easier to haul out of a deep car trunk.

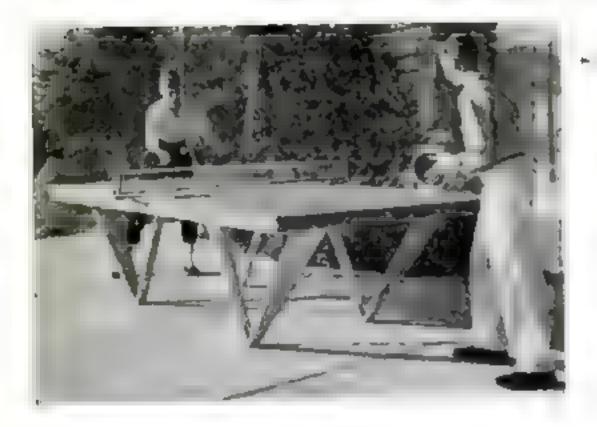
Fitting it out for tools. This is a matter of individual preference. If the box is to be used for permanent tool storage (it'll hold a small shopful), you can install racks tailored for specific tools. If it's to be used for carrying all types, equip it with universal holders.

I fitted mine with coil springs on hooks, a stack of leaf-type hold-downs, standard spring-steel clips, and the plywood rack, shown at right. So far, no tool has turned up that can't be carried undamaged and rattle-free.



DRILLED PLYWOOD EACK is independent of the tool box but is dimensioned to slip into an end pocket, between the glue blocks and the lengthwise partition. Lifted out, it's a tool stand.

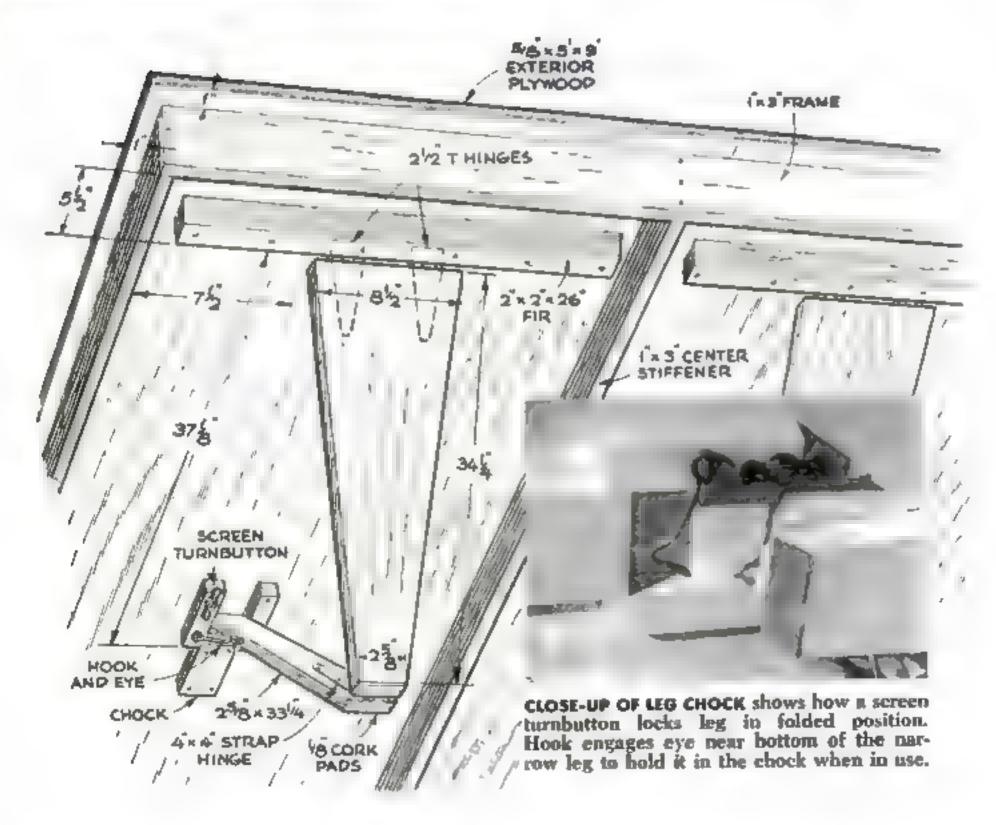
## How I Store a Tennis Table



### By Bob Gilmore

WHERE in the house can I put a table that's big enough for model trains or table tennis?" One reply to this common question might be, "Fold it into the ceiling—there's plenty of room up there."

That's exactly what I did. After making the table, I built a frame of two-by-fours to fit around its



### Overhead

sides. I hinged one end of the frame to the car-port rafters and rigged the other end with light block and tackle. To store the table, I lower the frame, place the table in it, and hoist away. For greater convenience, I could add a crank-driven winch.

Where appearance doesn't count, this arrangement can be used in the rough, as mine is. But in a finished playroom, you can nail furring to the underside of the frame and cover it with tiles to match the surrounding ceiling. That way the frame would disappear like a concealed panel when raised into its opening.

Except for the unusually sturdy inverted-triangle legs, my table is standard for table tennis. The top is a 5'-by-9' panel of %" exterior plywood, stiffened on the underside by a frame of one-by-threes set 1" in from the edges. A one-by-three fastened under the center of the table gives additional reinforcement. The legs, and the chock blocks the legs fit into, are ¾" plywood. Heavy strap- and T-hinges make the folding legs rigid against end shocks, and the wide upper end of the taper resists side-sway.

Grain-taming resin sealer was used to coat the entire table. Two coats of green blackboard paint were applied to the edges and top to produce a tough, glarefree, nonskid surface for playing.



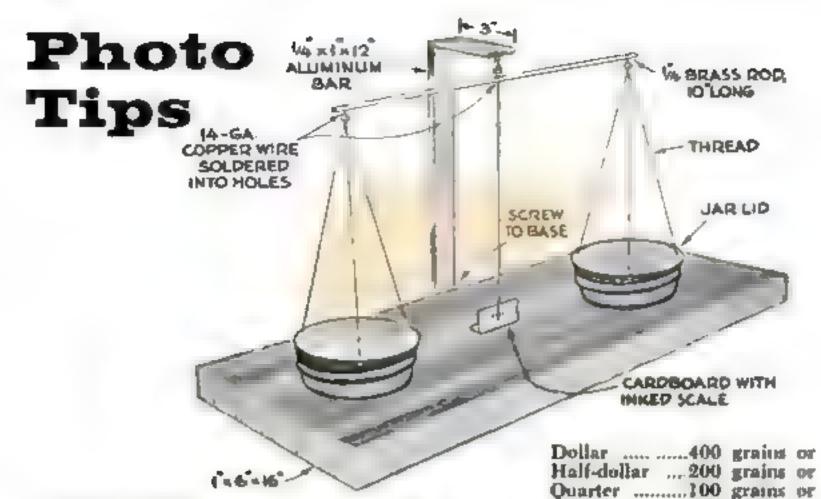


WHEN THE FUN'S OVER, fold up the legs and slip the table into its storage frame. The over-hanging edges of the table top rest on the two-by-fours, which hold it flat against the ceiling.



HOIST AWAY, and up goes the storage frame with the table neatly cradled inside it. Two double-sheave pulleys and ¼" Manila rope make up the easy-raising block and tackle.

IF YOU DON'T TRUST ROPE, lock the frame in place with two heavy hook-and-eye sets as an extra safeguard against accidental dropping. Note how legs fold flat against table.



A PHOTO SCALE sensitive to one-half grain can be made from scrap. To level it, cement small pieces of wire beneath the higher lid until the beam is balanced and the pointer centered. New coins make accurate weights:



A CAKE TIN inverted over a smaller one on a darkroom shelf makes a light-tight paper container. Coat the inside with black paint. Bolt or rivet a sash pull to the top tin for easy lifting.



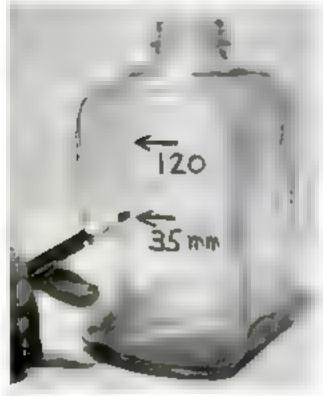
Nickel ...... 80 grains or

Penny ........ 50 grains or 3.25 grams

26 grams

13 grams

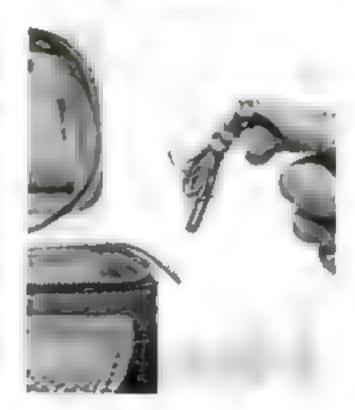
**ROUGHEN GLOSSY PRINTS** lightly with a typewriter eraser in spots where minor retouching is required. An ordinary lead pencil can then be used successfully for the touch-up job.



178 POPULAR SCIENCE OCTOBER 1960

carry russer sands
in your gadget bag
to keep exposed roll
film from uncoiling
Gummed tabs often pop
off, letting the film become light-fogged.

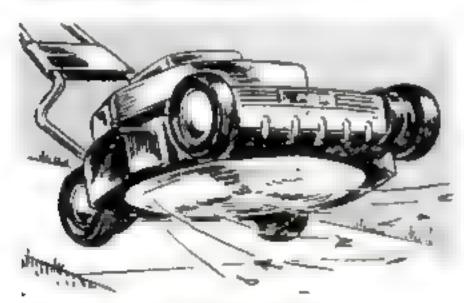
catilitate a north to gauge correct quantities of processing solutions for the various films you develop in a single-roll tank. You'll avoid wasteful spillovers. Water-proof adhesive tape marked with a grease pencil withstands repeated washings.





### Clothes-Closet Paint Guard

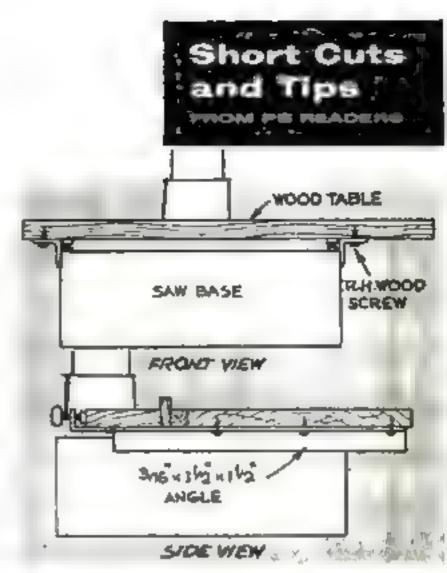
IN SHALLOW closets, the sleeves of clothing on hangers often protrude into the door frame. To avoid emptying the closet when repainting the jambs, slip a wood slat inside the frame to hold the sleeves back out of the way. Two brads and a few taps with a hammer will keep the slat in place while you paint.—A. I'. Deltuva, East Mendow, N. 1.



### **Mower Cleans Sidewalk**

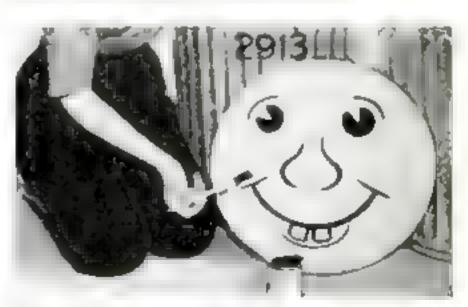
Most rotary mowers strew grass clippings over bordering walks and paths. Rough sidewalks and stepping stones are hard to sweep, but you can make the mower clean up after itself. Tip it back so that the front is 6" to 8" off the ground and push it along the walk on its rear wheels. The revolving blade acts as a fan and blows all debris off the surface.

—A. D. Allen, Plainfield, Ind.



### Unwarping a Saw Table

BASEMENT dampness caused the wood table of my radial saw to warp so that I couldn't make a cut of uniform depth I flattened the table by screwing two lengths of angle iron to the underside, as shown. Then I adjusted the table—following the instructions furnished with the saw—to make sure it paralleled the arm.—Roy Vigna. Casevrelle. Ill.



### Garbage-Can Cartoons

BRIGHTEN your collector's rounds by painting a face on the lid of your garbage can. You can bet he'll replace it on the right can. Your house number on the can will also prevent mixups.

TROUBLE starting your power mower these cool autumn days? Borrow your wife's hair dryer and train it on the cylinder fins.—Hurry Knight, NYC.





forms chip-proof surface that sands smoothly and takes paint beautifully. Homemade putty is resinmixed with wood flour (made on sanding disk.).

## The

## GOO with Million Uses

Fix anything? Sure—with epoxy

### By John Burroughs

POXY resin is catching on fast, and deservedly so. For my money, it's the most useful goo ever stirred by a stick.

I had my first look at this marvelous stuff a couple of years ago in a pattern shop. I'd admired a well-finished foundry pattern that seemed to be made of aluminum. But it wasn't solid metal, the patternmaker told me. He'd used a new "pattern compound"—glass-fiber-reinforced, powdered-metal-filled epoxy resin. He was enthusiastic about the stuff. Very easy to use, he said. He was through carving patterns from mahogany.

I bought a can. And since that day I've used epoxy in one way or another for most of the shop and homemaintenance jobs I've tackled.

For epoxy has turned out to be by far the best general-purpose shop cement—and wood filler, rustproofer, leak stopper, cold solder, glass adhesive, concrete



cement metal to Glass Permanently with epoxy resin. Rubber bands hold this label—a tin name plate snipped from a chemical can—in position until the resul cares completely



BOAT JOINTS are shown here held by the superpowerful adhesive. Fpoxy resin is preferred for laminated stems, chine beds, and the joints between longitudinals and the stem



FOR MENDING BROKEN GLASSWARE, epoxy is much stronger and more satisfactory than any volatile-solvent cement. Break in the tail of this crystal bird was invisible after the repair.

QUICKLY MADE ABRASIVE TOOL is circular-saw sanding disk brushed with rosm and sprinkled with coarse grit. Use aluminum avide to work metal, silicon earbide for other materials



nome-brew COLD SOLDER—epoxy filled with powdered aluminum—assembles or repairs aluminum parts, Lens-adaptor frame (above) was built up by comenting thin aluminum plates.

SET FLOORING NAILS FOR GOOD when remailing hardwood or underlayment. Coat the nails with coors and drop a drop into the pilot hole. Don't wait too long before setting the heads





patcher, and cracked-plaster-wall-fixerupper—I have ever used.

What is it? Epoxy looks like ordinary polyester resin, a sticky syrup with separate hardening agent. And it handles similarly. But epoxy beats polyester on two counts. It sticks like fury—to wood, metal, glass, ceramic, almost anything. And it's unbelievably tough,

The stuff is a wonderful adhesive. Epoxy wets a surface like a detergent, then cures in place. When cured, it's unaffected by water, oil, or any common solvent. It withstands heat to 250 degrees plus. And that's not all. It's also a matchless vehicle for mixing up an endless assortment of nonshrinking, putty-like filler materials.

To make various fillers, I've mixed in powered aluminum and bronze (sold in paint stores), fine-grit abrasives (dry rouge, aluminum oxide, silicon carbide),



RUDDER FOR \$LOOP was laminated of four layers of ½" plywood, using epoxy resin. Slots for the shaft were sawed in the inner two layers, and the shaft embedded in epoxy putty. The rudder was sanded to a teardrop contour and overlaid with epoxy-saturated fiber-glass.



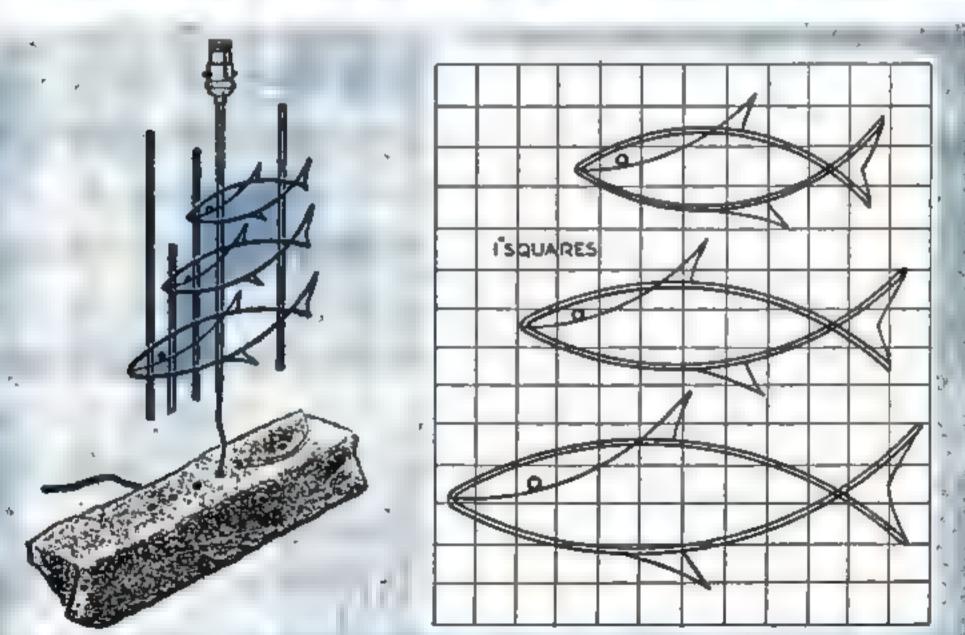
to stay permanently with metal filled epoxy.
You can smooth the resin compound - after it has cured thoroughly—with a rotary file





FIXING ROTTED TIMBER is another job for epoxy. After the decay pocket was chiseled out of this beam, the cavity was painted with epoxy and

packed with a filler made of one part resin (by volume), two parts fine sawdust, and three parts coarse sawdust (or wood chips).



CRAFT PROJECTS, too, make good use of epoxy. For this table lamp, brazing took care of the steel-rod fish. Epoxy cement held the assembly

in holes in the fleidstone-slab base. The holes were drilled with a carbide-tipped masonry bit. Center upright is tubing for wire.



REPAIRING JEWELRY AT HOME is simple with epoxy coment. To prepare small quantities, drip drops of resuland hardener onto a square of aluminum foil (edges folded up) and mix chemicals with knife tip.



HARDWARE HOLDS ON A PLASTER WALL if you use epoxy resin filled with fine abundance norde. Roughen the back of the bracket with a file, then apply the rement to both the bracket and its mounting screws.



AS GOOD AS SCREWS—and much easier—metal-filled resin was used to attach this view-finder mount to a camera. It will hold permanently, Epoxy is handy stuff for assembling all kinds of small parts.

fire clay, portland cement, chalk (whiting), sand, wood dust, milled glass-fibers, shredded asbestos. Any greasefree, reasonably dry material makes a satisfactory filler

How to use it. Shop-mixing your own epoxy compounds takes experimentation, since resin formulations vary. Some epoxy blends cure very hard. Others are tougher, with better adhesion. Mix a sample batch to check the result before using an untried filler on an important job.

Be sure to mix resin and hardener, and filler if any, thoroughly. Mixing, however, whips in minute air bubbles that turn the resin whitish, or cloudy. If you're using the epoxy as an adhesive, it's a good idea to warm the resin to about 150 degrees. This lowers its viscosity and brings the bubbles to the surface. Heating also improves penetration with wood or other porous materials.

Because grease or moisture can inhibit the chemical reaction that polymerizes epoxy, see to it that surfaces to be cemented are scrupulously clean. Curing time will vary considerably with temperature. Most epoxies harden in about 20 minutes when warmed to about 200 degrees with a heat lamp. When warmed to 100, curing takes about 2 hours; on a warm day with the air at 75 degrees, 12 hours; when the temperature is 65, 5 days.

Straight epoxy (unfilled), is sold in bulk for laminating, waterproofing masonry, patternmaking, repairing auto bodies, patching boats, and other uses. For general-purpose cementing and for mixing small quantities of various fillers, I like straight resin.

When you need a sizable quantity of powdered-metal or glass-fiber-filled epoxy, it's waser to buy a commercial epoxy-based product with filler already added. There are many such putties on the market, and all I've used are wonderful.

Epoxy's fairly expensive. A pint costs about \$5. But a little resin goes a long way when you extend it with filler. And anyhow, the result is worth it.



### Nameplate Shadow

You get double duty from an outside name-and-number plate if you cut it from aluminum sheet and suspend it like this. On sunny days its shadow shows on the wall behind.—Max Tatch, Hollywood.

### Furniture-Leg Extension

Don't use unsightly blocks to level furniture on uneven floors. Instead, cut a neat extension for the short leg from a mop or broom handle and stain it to match. Attach with a wood screw and cover the screw with a furniture glide.

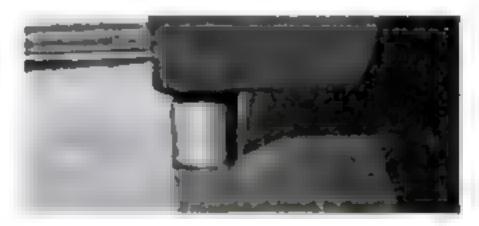
—Wayne Floyd, Fayetteville, Tenn.

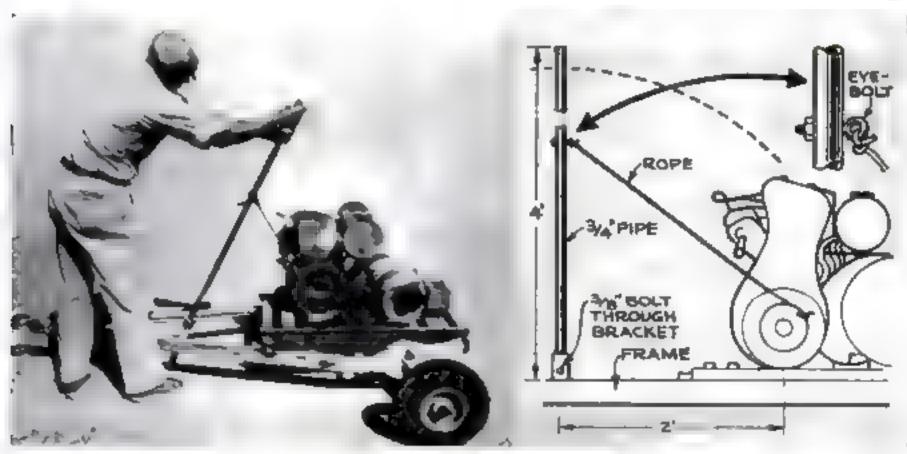




# Staples from Tire Chain

Discarded tire chains are a good source for heavy-duty staples. Cut at a 45-degree angle for easy driving, the links offer a variety of sizes and shapes.—John Mihalick, E. Liverpool, Ohio.





# Starter Handle for Engine

A PIVOTING handle provides a safe, convenient way of pulling a rope to start a small engine. I mount the engine on a frame of angle iron and locate the handle pivot 2' from the center of the motor pulley (sketch above). With the rope adjusted for length and tied to an eyebolt on the handle, I just pull the handle to start the engine.—Donavan Lathrop, Saguaro National Monument, Ariz.

# How to Use Wheels to Save Your Back

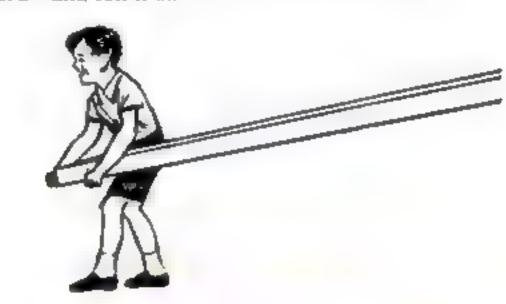
These tricks with rolling stock are guaranteed to ease many backbreaking jobs in home and shop

By Darrell Huff

# Extra help from a WHEELBARROW

Suppose you have a stack of timbers, each weighing 200 pounds, to move from one end of your driveway to the other-but they're far too long to balance on a wheelbarrow. Use a wheelbarrow anyway, drafting a small boy as outrigger. He'll keep the load balanced as you roll along

Heavy stones or paving blocks, though easy to wheel, are backbreaking to lift. A simple solution: Lower the rear of the wheelbarrow by blocking up the wheel. When loading a barrel, drum, keg, or anything else that will roll, go a step further: Add a ramp in the form of a plank or piece of heavy plywood-and roll it on



# A MOVING MAN'S best friend

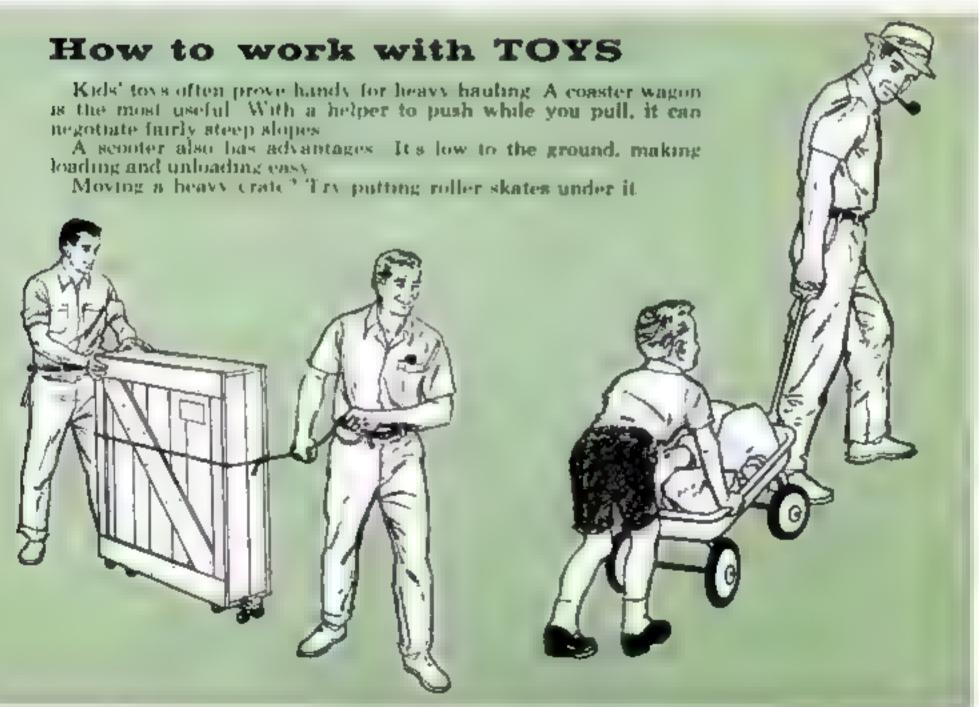


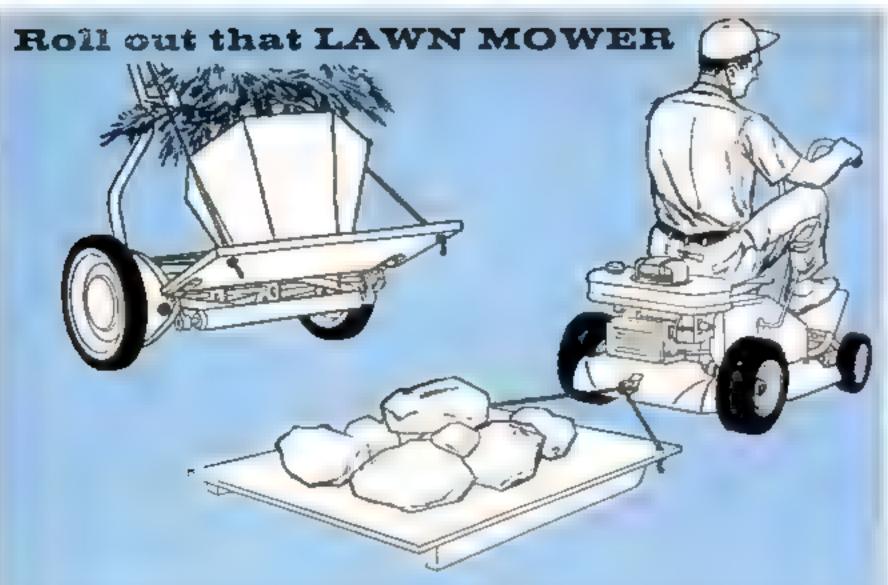
A hand truck is your best bet for wrestling such heavies as refrigerators and trunks, but what about a potted plant or a small tree growing in a box? Low or plump shapes like these are hard to handle on an ordinary hand truck with its short loading platform.

So fatten that surface with a temporary extension—a sizable square of plywood bolted on securely.

For heavy-duty hauling, a permanent setup is better yet. A heavy strap steel extension preferably welded on, can handle almost any odd-shaped load, and the hand truck remains useful for toting conventional cargo.







A lawn mower has moving potentialities you may not have thought of Turn over a hand mower so that the drive edgs do not engage as you push it, and you have a ready-made means of transporting various

objects short distances.

You can easily make an adaptor to turn the mower into a hand truck. Cut a square of plywood a few inches wider than the mower. To secure the two rear corners to the grass-catcher hooks, bolt on S hooks, available in hardware stores, or short pieces of strap iron drilled for mounting Drill the other two corners of the plywood

and run ropes to the ends of the handle.

A power mower, especially one that you ride, can be equipped with a variety of accessory-hauling attachments, if you don't have such an attachment, try towing a child's coaster wagon or a homemade version of the old New England stone boat -a sturdy, low wooden sied. Plywood or planks cleated together can be used for the top of the boat. Runners can be shaped from two-by-fours or heavier lumber, depending on the ruggedness of the work to be done and the durability you wish to build in to your stone boat



# Rolling on PIPE

Four or five pieces of pipe are a good emergency answer to many heavy moving problems. Lift the object onto three of them, then roll it over the fourth. Each time a pipe is cleared, move it to front position. Largediameter pipe is best, but small water pipe will do the job, too.

When crossing a lawn or rough ground, roll

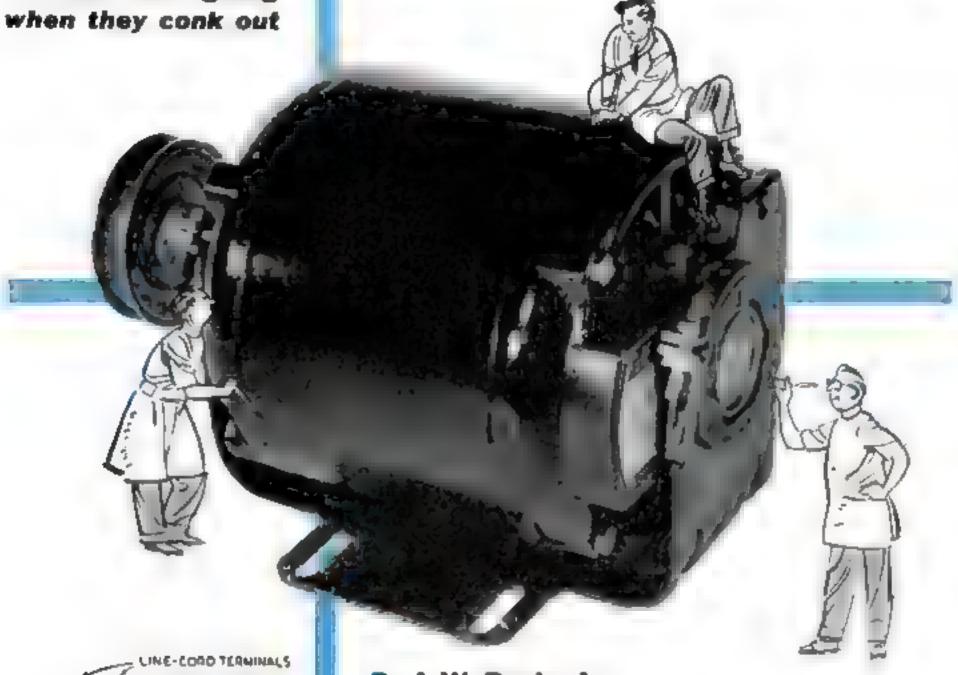
the pipes over planks.

# **PS Favorite**

This article, readers' choice for rerun of the month, originally appeared in January '55 PS. Judging from many letters we've received, it's as timely today as it was five years ago. Have you an old favorite you would like us to repeat? If so, send in your vote.

# There's no mystery to trouble-shooting these shop helpers. Here's what you do to start 'em going when they conk out

# Sure Cures for Ailing Shop Motors



SMITCH POINTS
STARTING WINDING
MAIN WINDING

wiring plagram for a splitphase motor. In actual practice both windings have a number of coils. The starting winding is cut out when the motor comes up to speed and centrifugal force opens the switch. To reverse such a motor, switch leads to either winding, but not both.

By J. W. Rocke Jr.

IKE'S shop was closed, but he was in and opened the door for me. Inside, I set down the electric motor I had lugged along.

"It just sits and hums. Hate to bother you on a Saturday, but I can't run my lathe without it. Your wife said you wouldn't mind—"

Mike Evans grinned. "Think I've forgotten how you started my car after that cloudburst? Glad to help."

I kicked the black brute on the floor "Best motor in my shop, but it picks today to quit on me, just when I have a weekend to finish that HO locomotive. Think you can save it?"

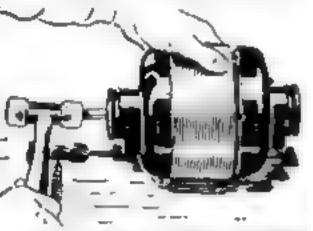
"Let's see," said Mike. "Bring it here."

I toted the motor to his workbench and he plugged it in. But it didn't work for him, either,

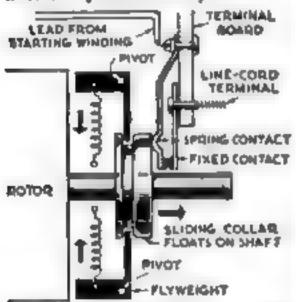
"See?" I said. "It hums, but doesn't turn—" I gaped, for Mike had given the pulley a twist and the motor was spinning contentedly.



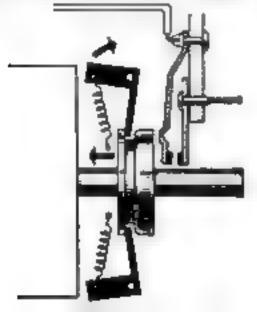
MARK STATOR FRAME and both end bells by making punch dimples close to each other. This will enable you to reassemble them in the same position.



the motor together. Use a lead or plastic hammer to tap motor shaft, as above, if the end bell does not pull off easily.



CENTRIFUGAL SWITCH works like this. When the motor is at rest, flyweight springs hold the shding collar against the spring contact, closing the starting circuit, as shown in sketch above. As the rotor reaches running speed, centrifugal force overcomes the springs; the weights fly outward, pulling the collar away and letting the contacts open, as below. There is no wear on switch while motor runs.



"Hey! What'd you do? It wouldn't run for me!"
"Take it easy," Mike answered. "We'll just let it run
a bit before we start trouble-shooting."

He laid a hand on the motor as it purred on.

"Sorry I bothered you," I said. "Maybe the plug wasn't in tight. I'll take it back."

Make shook his head. "Not yet you won't. Something's wrong. But there's no sign of overheating, so we'll look for it in the starting circuit."

He pulled the plug, then punch-marked the motor housing in four places and unscrewed four nuts. Taking off one end of the motor, he frowned over a U-shaped piece of fiber encrusted with brass strips.

"Those contact points are dirty," he said. "And

there's a thick film of oil on the whole works."

"Sometimes there's a fat spark inside the casing after I turn it on. But how could oil be the trouble?" I asked, "It ran a minute ago."

"If you don't mind a short course on AC motors, I'll tell you," Make offered. As I nodded he went on.

"Well, in this outside case you have what amounts to a circular electromagnet. Shoot alternating current through it, and you have an intermittent pull—on and off 120 times a second, Right?"

"Yes, but if it's just on and off, why should the

shaft turn?"

"Good question. You need a rotary or twisting magnetic field for that. So the field magnet has a second set of coils." He pointed to them. "You see they're between the main windings. So their pull comes 90 degrees later, and you get an out-of-phase field that twists the rotor hard."

"Oh, I see-no I don't. If it's that simple, why the

brass spinach inside the end cover?"

"Because you don't need both windings, once the motor comes up to speed. You saw me start it by twisting the pulley—it kept going on the running winding only. The light starting winding is in series with these contact points."

Mike was cleaning the fiber plate while he talked,

with something that smelled like carbon tet.

"You see," he said, "this sliding collar on the rotor shaft is pressed against one flexible contact by springs when the shaft is stationary. Once it spins, centrifugal force makes these two weights fly outward, drawing the collar in and opening the contacts."

"I'm with you," I said "If the contacts are dirty, they won't close right, and you get no starting twist.

But what about that sparking I saw?"

MAIN PARTS of a typical split-phase motor look like this. Blow out loose durt and wash parts with carbon tetrachloride.



"Watch," said Mike. He disconnected a wire, then touched a test lead to each terminal, while pressing

the contacts together

"See that? The bulb doesn't light. These points are so burned they won't pass current. What burned them was the arcing you saw—every time the motor was started, they burned more."

"But why? Other motors in my shop have run longer.

And this is the best one I've got."

Mike grinned. "You killed this one with kindness. Probably oiled it every time you used your lathe."

"Sure, I don't want it to run dry."

Make shook his head "Over-oiling makes trouble Extra oil is thrown on the contacts, making a high resistance that causes overheating. On the break, you get arcing—and more heat."

"After this," I promised, "I'll oil it once a month."

"Once every three months is plenty," said Make as a young fellow came in from the back room. "And only a drop or two at a time. You know Bud Edwards?

He helps me Saturdays."

Bud nodded to me. "Mr. Evans, will you take a look at the motor I'm working on? The starting contacts were practically welded together I cleaned them, and the windings check out fine—but the motor still won't start."

"See anything strange in that, Bud?"

"Strange? No, sir."

"Mm-seems odd to me that the starting windings aren't burned out, if the contacts were stuck together."

Bud leaped as if stung. "Gosh, yes! With juice going through all the time, they should be burned out unless—I get it! It's a capacitor motor, and the capacitor must be open and not passing current, or those windings would be gone. I'll check."

He bounded off. Mike dressed the contact points

with a fine file and washed the works again.

"Look, Fred, I'll show you how to check motor windings. First disconnect all the leads on the terminal strip, because you want to test each winding separately. It's smart to identify each wire and terminal with marked bits of tape as you go."

Having removed four wires from the terminal nuts,

he picked up the test leads he had used before.

"This is a simple test circuit you can rig in five minutes. Touch one of the test leads to each end of

a good winding, and the bulb lights."

He touched the leads to the two heavier wires, and sure enough the bulb glowed. It glowed again across the two lighter wires. Then he touched one end of each winding and nothing happened.

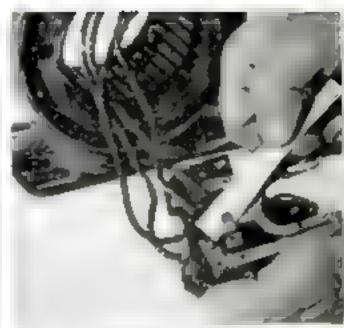
"Hey! Is that bad?" I asked.

"No, that's good. If the bulb lit, it would indicate

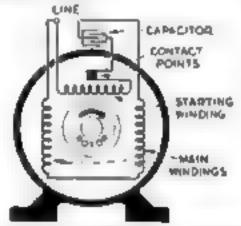
a short between the two windings,"

Mike made one more test. Holding one lead on the bare metal of the stator frame, he touched the other to each winding. No glow.

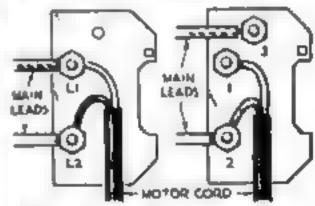
"Bad?" I asked anxiously.



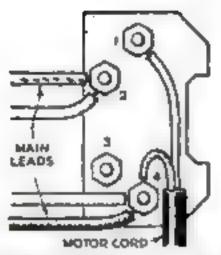
clean starting switch carefully with a folded strip of sandpaper as shown above. Then wash contacts and terminal strip in carbon tet to remove oil and grease. Be careful not to bend the contacts askew or alter the spring tension.



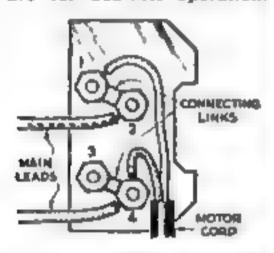
capacitor-start motors, which have more starting torque than split-phase types while drawing less current, have a heavy-duty condenser or capacitor in series with the starting winding. By momentarily storing current, it provides a starting boost. It also absorbs the surge that occurs as the points open, and so reduces areing. Heavy-duty capacitor motors may have such a condenser in series with the main winding as well as the starting coils.



rour wires come to the terminal board from inside the motor. If only two are visible, the others are connected on the back of the board. Reversing the two main leads (above, left) will change motor rotation. If in doubt, disconnect two winding leads and use a test lamp to find two ends of one winding. Motors with a thermal-overload switch may have a terminal block as at right. Interchange leads at terminals 2 and 3.



for motors that can be connected for either 115 or 230 volts are shown here. To reverse the one above, the main leads must be positively identified. A mistake may damage windings. If in doubt, write the manufacturer. To reverse a motor having strap connectors (below), interchange two main motor leads, Hookups shown are for 115-volt operation.





tors have a commutator and brushes, here visible with end bell removed. The brushes ride the commutator constantly. To reverse such a motor, shift the brush ring according to marks on the end bell. Repulsion-start motors are similar, but the brushes are automatically lifted off the commutator at normal running speed. If brushes are not properly set, starting torque may be low.

"No, good. Any glow now would indicate a ground—some of the winding in contact with the frame."

I shifted my mental gears. "So what? The thing

would still run, wouldn't it?"

"Right. But the motor is bolted to the lathe, and you touch the controls, and your cellar floor is concrete, so it could give you a nice, juicy jolt. That's why shop motors ought to be grounded. Just run a wire from a clean spot under a motor bolt to a water or steam pipe, and you'll be safe."

"Thanks, I'll do that—"

"Mr. Evans!" It was Bud back again, a bit wild-eyed this time. "I checked that capacitor, and it was open. So I put in a new one, but it still won't start!"

Mike glanced at me. "Mind if I take out a minute to look? Yours will be okay when I put it together."

We went to Bud's bench. The motor on it had a round black case at one end

"That's the capacitor," Mike explained, "The old one probably broke down, causing arcing across the contacts, which welded them together."

Thoughtfully he looked at the motor, twisting the shaft. Suddenly he stopped turning it to push it end-

wise instead. His eyes roved the bench top.

"What's this, Bud?" he asked, picking up a fairly

thick fiber washer,

Bud's ears went red. "I-gosh, that's a rotor-spacing shim I forgot to put back. I'll take the motor apart and put it back right away."

"Do that, and then call me," said Mike.

He led me back to his own bench. I itched to ask him why he didn't stay to check the inside of the motor while Bud had it open, but kept quiet.

Mike reconnected the leads to the terminal strip of my own motor and reassembled it with punch marks together on the housing Making sure the shaft spun freely after the frame bolts were tightened, he plugged it in. It turned, clicked gently, and kept running.

"Good as new," said Mike "And paid for since that

rainy day last month. Don't argue."

I didn't argue, for Bud stuck his head in sheepishly just then. We went back to the other workbench with him.

"I put the shim in, Mr. Evans. Now will you see

what's wrong?"

"I don't think there's anything wrong now, Bud. You fixed it." As he spoke, Mike plugged the motor cord in. The motor promptly went into action. "But—but it didn't work before!"

"Because the shim was missing, Bud."

I was as puzzled as Bud looked. "I don't get it, Mike. What does the shim do except prevent shaft end

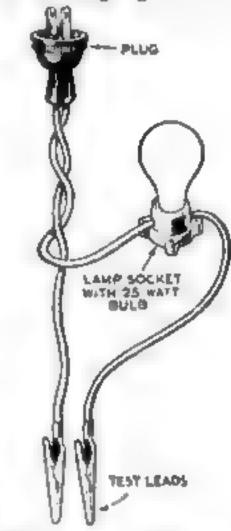
play?"

"Nothing. But if this shaft has too much end play, the collar doesn't bear against the starting contacts hard enough to close them. No juice gets to the starting windings, and the motor doesn't start. Bud fixed it when he put the shim back."

### TROUBLE-SHOOTING CHART POSSIBLE CAUSES REMEDIES SYMPTOMS No hum or action of Blown fuse, faulty switch, faulty line Check each and repair as tord, broken interpol connections perimed. ony kind Open capacitor in capacitor start and Check capacitor, and rerotom mura ploce. Check windings for char-Motor burned out ring. Rewind. Check for break, and re-Motor hums, but will Broken leads in starting winding cirnol start PRICE Starting-contact points dirty Test and clean Rework as required to make Starting-contact points not making contact when motor is not FURRITO Excessive and play in reter shaft hold-Show rotor shoft with fiber woshers to reduce and play ing contact points open to 1/64" Check and replace, (Emer-Starting capacitar open gency operation possible by wiring capacitor leads logether, and operating motor as straight spotphase ] Operate without load and Mater everleaded Motor heats excessee If healing centinues DI MORKY. **Ventilation has failed** Clean vents and blow out motor housing with gir internal grounds or short circuits in Check windings for shorts and arounds. Rotor dragging on stator due to worn Inspect rater, check bearbearings ings and replace as required Bearing tight due to lack of lubrico-Treat as required. tion or improper alignment of end Try onother or lighten Pulley out of balance or loose Excessive vibration Worn bearings Replace bearings Rator out of bolonce Move report shop balance Internal shorts in running windings Have checked at a repair thea. Meter and load misaligned Correct alignment



CHECK SPRING ACTION on the flyweight assembly. Weak or broken springs may not press the sliding collar firmly against starting contacts. Lubricate collar only with a grease stick. Never use oil or light grease on it.



# A test lamp makes it easy to find breaks

Starting winding shorted ar grounded

Windings of starting winding shorted

Copacitor looking internally, or too

terminal strip. Running or main winding has huskier coils than starting winding. Test lamp is wired as in sketch at right. Use insulated test leads or clips to avoid shock. Touch one to each end of a winding (below). If the lamp does not light, look for break in connection of leads to winding. If the break is internal and can be located, repair by splicing and insulate well. If break cannot be found, have motor rewound.

Low line veltage

internelly

to each other

Motor sluggish and

frow to start even

without a load

Check for grounds between both the windings and frame, too. If lamp lights with one clip on bare metal and the other touching any winding lead, locate short and insulate at that point. Motor may run with a ground, but it is a shock hazard. Also check for shorts between the windings by touching test clips to one lead of each. Make sure all leads are off terminal strip for this test. If the lamp lights, try to determine where the windings make contact.

Check line veltoge; check

Check starting winding for

short to main winding and states Repair or sewind.

Requires chucking by a

motor-repair thep, rewind-

Hove repair shop check

line for overload

ing necessary

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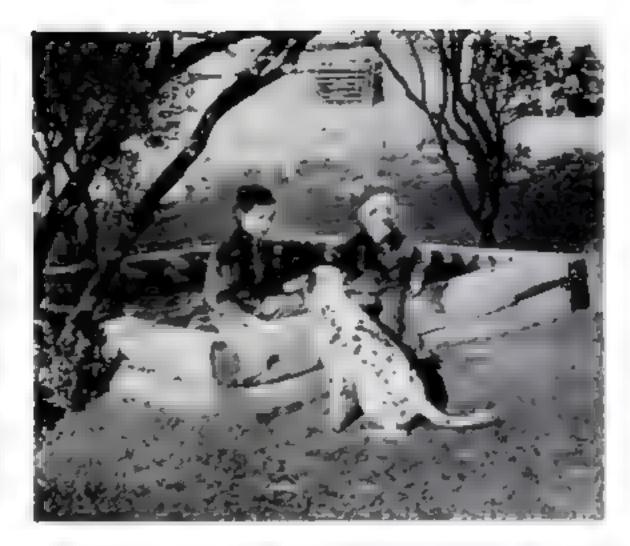




# Short Cuts

### Sandbox Built to Last a Lifetime

SPIKE eight discarded railroad ties together to make a rustic, king-size sandbox. The bulkiness of the ties forms a bench around the play area and assures that the box will stay put. Just about indestructible, the box shown is entertaining its second generation of kids.—Darrell Huff, Pacific Grove, Calif.



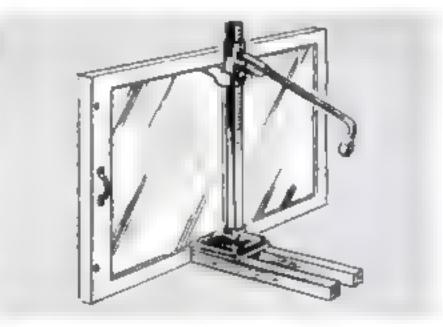
>>>You can compute rainfall by using an empty paint-spray or other can with an inside diameter of 2 25/32". Cut off the top evenly and set the can in the open, away from trees and buildings. A weight inside, to keep the can from blowing over, will not affect the reading. After a rain, pour the contents into a 100-cc. graduated cylinder to measure the

volume. Since 100 cc. is equal to 6.1 cubic inches (1" of rainfall on an area of 6.1 sq. in. or a circle with a diameter of 2.785"), each cc. in the cylinder equals 1/100" of rainfall. For snow, press the open end of the can through the snowfall to a hard surface, compacting the snow in the can. Melt and measure.—W. E. Helmick, San Marino, Calif.



### Rod as Flexible Drill Shaft

Drilling in places where there's no room for the electric drill is easy if you have an 18" or 24" length of \(^1/4\)" cold-rolled rod brazed to the shank of the drill bit. The rod will flex and transmit power like a flexible shaft, permitting you to drill around objects that would ordinarily be in the way. The braze will be stronger if you turn down the drill shank to \(^1/4\)" diameter or use a drill with the shank already reduced.—James A. Lockhart, Bryan, Ohio.



### **Bumper Jack Salvages Glass**

IN MY business—installing aluminum windows—I often remove old wood sash from homes. After trying many unsuccessful methods of removing old glass quickly, I found that placing a car bumper jack against the top and bottom of the window frame forced the sash apart in seconds, freeing the glass for re-use. (I prop the jack on blocks to make it easy to slip the sash under the base.) Only about one pane in 50 was broken using this method.

—E. McGuire, Yankers, N.Y.

# Canvas Panels for Indoors or Out

# By Paul Corey

INEXPENSIVE canvas panels will serve as fences, windbreaks, sun screens, or a patio roof. Indoors, similar panels become room dividers, movable partitions, and decorative backdrops. You can even make several basic screens do double duty. Use them outside in summer, inside in winter.

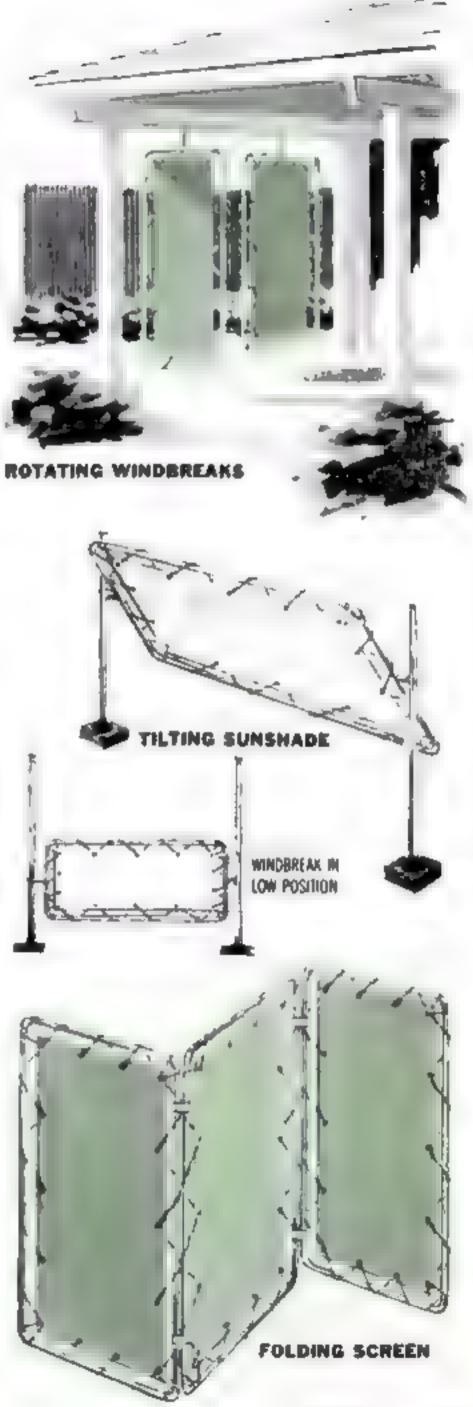
Because of its light weight, canvas can be simply framed, saving the work and cost of heavy construction. Lashed to slim poles, it can be put up or taken down as you need it. Outdoor screens can be removed in winter and stored away to prevent weathering. Portable screens can be moved around your home or yard, even taken along on vacation trips.

Vivid colors in solids, plaids, and stripes also make canvas ideal for modernizing a home. From time to time, you can add new colors and patterns, using the original frames.

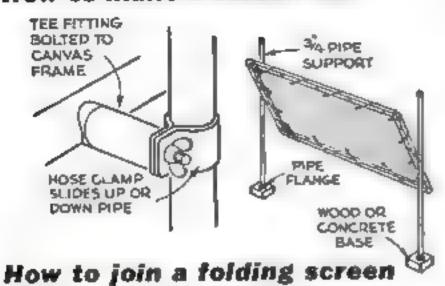
How you buy caneas. You'll find the terms canvas and duck used generally to mean the same thing, although duck is a slightly lighter weave. Both are heavy cotton and are tough and durable.

Weights range from 10 to 15 ounces a square yard. The 15-ounce type is the heaviest but can be sewn on a home sewing machine. Use the largest nylon thread the machine will take for best results.

Plain canvas comes in widths from 29" to 72", colored canvas in widths



# How to make a screen tilt



THREE PANELS
HINGED TOGETHER
HINGE MAPE OF PERFORATED

from 15%" to 31". Plan your job to take the widest available widths and you'll cut down the number of seams.

Cheaper grades of colored canvas are printed and the color shows on only one side. The more expensive grades are woven with colored threads and the pattern is the same on both sides.

Plain white canvas costs as little as 60 cents a square yard. Colors and patterns go up to \$2 or more a square yard. For outdoor uses, be sure the colors you buy are fadeproof.

Fastening is easy. For a quick job, canvas can be simply tacked or stapled to a light wood frame. There are a number of special fasteners on the market, however, that give a slicker-looking result and also enable you to put up or take down the canvas quickly.

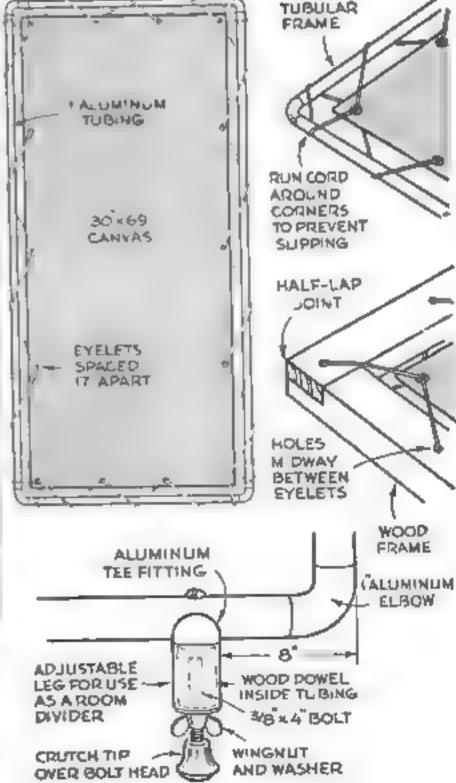
Eyelets (also called grommets) make it easy to lace canvas panels to any kind of frame. 'Lurn and snap fasteners, the

# How to make a basic canvas panel for use anywhere

HANGER STRAP

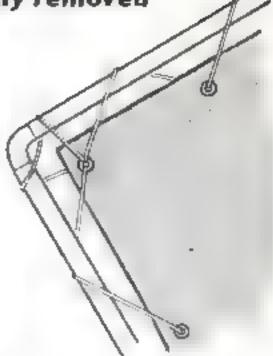


AS A ROOM DIVIDER, this portable canvas panel adds color and privacy to living areas, can be moved quickly. It rests on two short legs that can be adjusted in height, as in the drawing at right, to wedge the screen against the ceiling. Basic panel is 6' tall, 34" wide, uses only two yards of 30"-wide canvas. Frame is 1" hardware-store aluminum tubing.



# Three ways to fasten canvas so it can be quickly removed



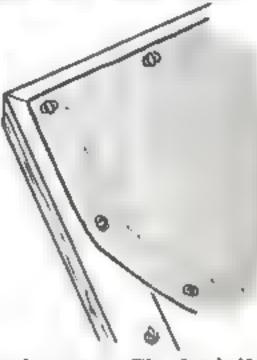


### 1. Lashing canvas with cord

METAL EYELETS allow you to lace canvas without tearing it. Cut holes for the eyelets with a special punch hammered into the canvas over a wood block (left), Slip the larger eyelet half through the canvas and set it, neck up, on a metal anvil (center). The other half is then placed on top and the neck rolled down over it with a setting tool. Inexpensive cutters and setting tools can be bought or rented at hardware or boat-supply stores selling eyelets.





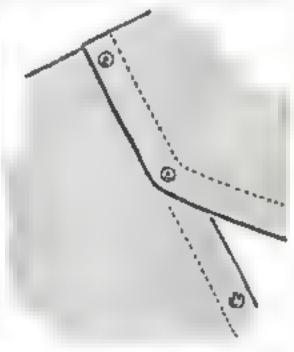


### 2. Attaching canvas to wood

TURN FASTENERS have threaded study that screw into wood (left). Rings in the canvax slip over the study and are locked on by twisting the tops of the study crosswise. Snip out an oval hole to match the ring's opening and press the

pronged half into the canvas. The flat half is then placed on top and the prongs hammered down over it. A similar stud is also made for mounting in canvas when you want to edgejoin two pieces of material for easy handling.





### 3. Joining canvas to canvas

SNAP FASTENERS consist of a pronged stud set in one piece of canvas and a matching ring in another. This lets you quickly snap the two pieces together or pull them apart. Press the prongs through the canvas (left), then turn

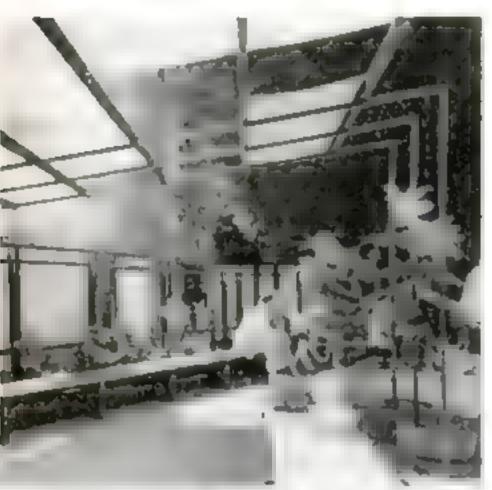
the stud over into a small hole in scrap wood. A washer is slipped on top and the prongs crimped over it (center). The ring is installed in the same way. Studs with a screw shank are also available for fastening to wood.

kind used on boats, let you attach canvas to wood. The fasteners screw into the wood and the canvas hooks over them. If you don't want to handle one large sheet, you can edge-join several smaller panels with still other types of fasteners. How these different fasteners work is shown in the photos.

All-purpose panel. The single panel of canvas shown in the photos and drawings can become anything you want it to be without changing its size or basic design. Fitted with legs, it's a room divider. With swivels at the sides, it's a tilting sunshade. With a single pivot at top and bottom, it can be a rotating screen to let in or block out the breeze, as you wish. Several panels lashed together become a portable folding screen.

The panel shown takes only two yards of canvas 30" wide, making it about 6' tall. With the ends hemmed, the material becomes about 69" by 30" (no hems are needed at the edges). If the canvas is to be lashed to the frame, as here, the frame should be made about 2" larger all around. If the canvas is to be attached directly to the frame, the frame should be exactly the same size

Besides canvas and frame, the only other materials you need are 14 eyelets and 30' of Venetian-blind cord. The cord can be obtained in colors if you want it to match or contrast with your canvas.



CANVAS ROOF for a patio needs only a light wood frame for support because of its very low weight. The canvas strips, snap-fastened on, can be removed in winter to avoid snow-loading.

Making the frame. You have several choices here. One of the nicest materials to use-although not the cheapest-is the type of do-it-yourself aluminum tubing readily available in hardware stores. It comes with a full line of fittings for making corners and T joints.

Ordinary 1/2" plumbing pipe can also be used except that it's not possible to screw all four corners together without loosening one or more of them. One answer is to insert a pipe union, but this adds a bulky-looking fitting. If you're handy with a soldering torch, an inexpensive frame can be made by sweating

together rigid copper tubing.

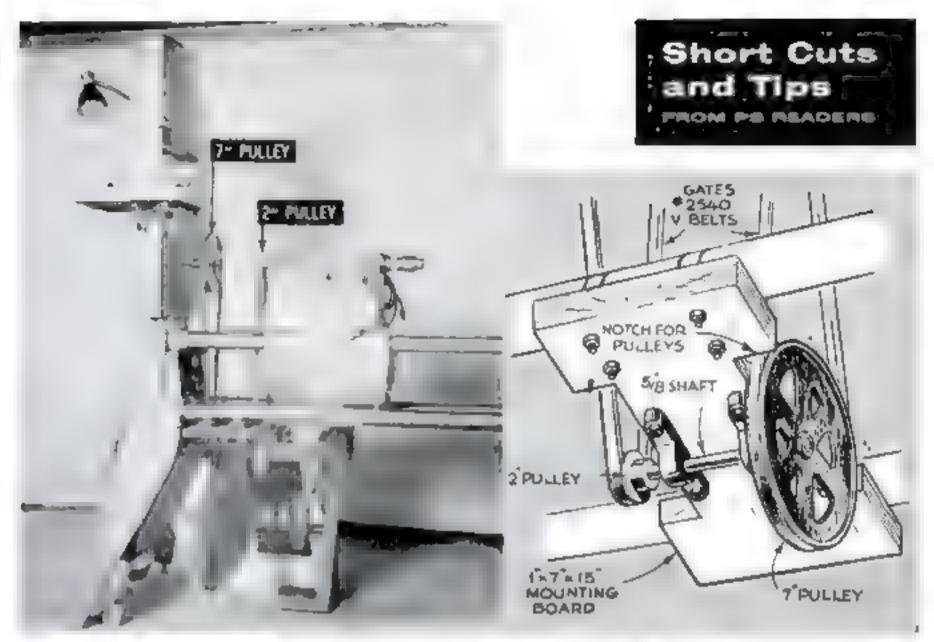
A wood frame is the cheapest and easiest to make. Outdoors, a frame of redwood or cedar is both retproof and rustic-looking. With this type of frame, you can either lace the canvas to holes drilled in the wood or attach it directly to the wood with the special fasteners. With pipe or tubing, the only practical way is to lash the canvas on.

In locating your fasteners, there's one important difference: When lashing canvas to wood, the holes in the frame should be placed midway between the eyelets so the cord runs diagonally from eyelet to hole to eyelet, and so on. When attaching canvas directly to wood, the fasteners in the frame must be placed exactly opposite the eyelets because the evelets book over them.

Mounting the panels. For a room divider, an easy way to install a canvas screen and keep it movable is to use the adjustable feet shown in a drawing. These consist of wood dowels inserted in the frame's legs and drilled for bolts. A wingnut on each bolt permits the legs to wedge the screen between the floor and ceiling.

For a wood frame, insert the dowels directly into holes drilled in the base. Use two-by-threes or two-by-fours for the frame to provide sufficient bearing area for the dowel legs. For a legless frame, one-by-four lumber will do.

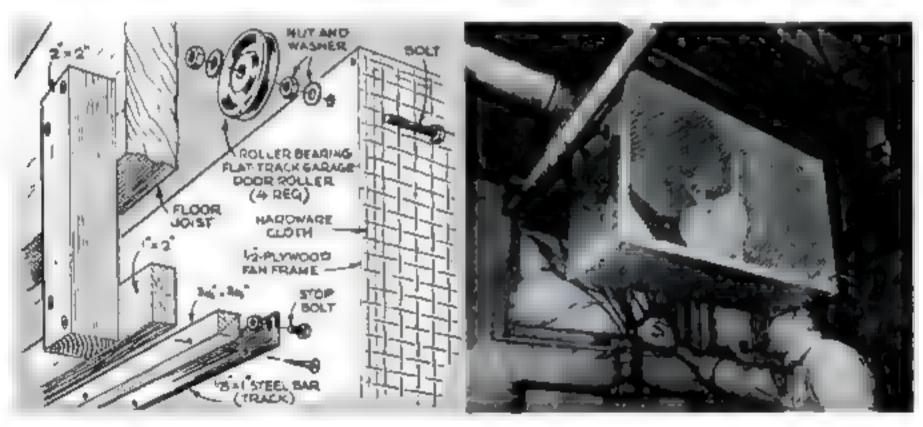
A panel with a single leg at the top and bottom will give you a rotating screen to control sun and breeze like a louver. The ends of the legs can be held loosely in pipe flanges or in holes drilled in blocks of wood. The drawings show other arrangements for making tilting and folding screens.



# Speed Reducer for Shopsmith

THE bandsaw unit of my Shopsmith ran too fast to cut steel. So I made a speed reducer from two 2" and two 7" V-pulleys and a 7" length of \(^6\)\" shaft. This is mounted on a board beneath the

machine, as in the mirror view at left, with aluminum straps that pivot on the front rail for tensioning the belts. It drops when not in use and need never be detached. One 7" pulley goes on the bandsaw and one 2" pulley on the drive spindle.—A. G. Haeberle, St. Peters, Mo.



### **Overhead Track for Fan**

Instead of taking down your basement ventilating fan and storing it for the winter, install rollers on the housing and mount it on a track suspended from the joists. This way you can roll back the fan to open the window, and push it into the opening to air the basement any time you like.

Use flat-track garage-door rollers and a steel-bar track, or roller-skate wheels riding in a wood track made to fit.—Phil McCafferty, Cedar Rapids, Iowa.



# Plywood Table for a Router

A SIMPLE plywood table and two fences to fit it will enable your router to do the work of jointer and shaper. The table stores out of the way easily and can be set up in a minute.

Two carriage bolts fasten the table to the edge of your workbench; two braces add rigid support. The router baseplate is bolted to the underside of the overhanging part of the table, and a 1½" hole is drilled directly above it for bit clearance. After the first assembly, the bolts that hold the router can be permanently set in the table by bedding the heads with epoxy glue.

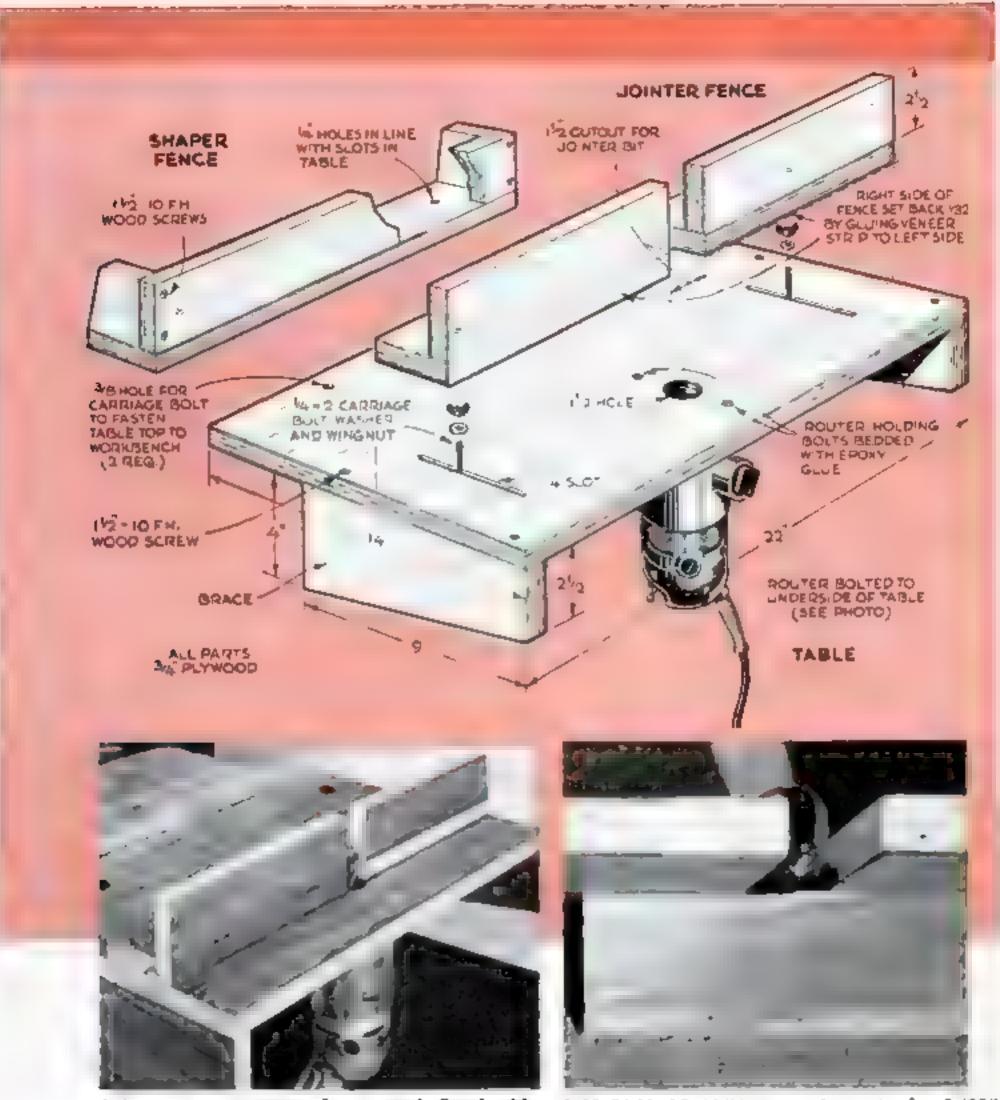
Both fences should be about as long as the width of the table for maximum sup-



BASEPLATE OF ROUTER is bolted to the underside of the table. The router's depth-of-cut adjustment can be used to extend the cutter bit to the required height above the table.

port of the work. The shaper fence is made by fastening two  $2\frac{1}{2}$ "-wide lengths of plywood together at 90 degrees with glue and screws. End braces hold the upright piece square to support work held vertically against it.

The jointer fence is similar, except



SET UP FOR JOINTING, the router is fitted with an accessory jointer bit and arbor available from most manufacturers of routers. It will joint edges of boards up to 1%" thick.

that it is cut out in the center to fit around the jointer bit, and the outfeed face is made to extend ½" beyond the infeed face. Do this by gluing veneer strip to the base edge before attaching the outfeed upright. This offset provides firm support at both sides of the fence

LEFT FACE OF JOINTER FENCE protrudes 1/32" farther than the right side to support the work after it is dressed. The left side must be set flush with the cutting edge of the bit.

for work being jointed. A special jointer bit with arbor is available at about \$10 for most routers.

Both fences are adjusted by sliding their hold-down bolts in slots cut in the table top near the sides. Wingnuts make adjustment easy.—Claude Venon.

# New Ideas in Photography



# **Automatic Camera is Amazingly Accurate**

This automatic electric-eye camera is not only easier to operate than a separate light meter and camera—it's also more accurate

The reason? In each Brownte Starmatic Camera, the built-in meter and shutter are custom-matched to each other by a final factory adjustment. Thus, any of the common variations of meters and shutters are balanced out, and exposure errors are eliminated!

Shoot in bright sunlight or in shade, the lens opening adjusts automatically for correct exposures. When light is too dim, a signal tells you to use flash.

You get snapshots or slides, 12 beautiful pretures to a roll on economical 127 film. Can't take an accidental double exposure. Browne Starmatic Camera costs less than \$30, or as little as \$3 down.

# "Electric Fingers" Thread the Film For Automatic Movie Projectors

Now you can get your movie shows under way with no fuss, no fumbling. Just choose a Kodak automatic movie projector

All you do is insert the end of the film in a slot. "Electric fingers" then take over, to start your show automatically. They thread the film through the gate... form the loops... and guide the film down to the take-up reel, which picks it up automatically! It's quick, reliable, all automatic, and astonishing to see.

There's a Kodak 8mm automatic movie projector in every price range. See them at your dealer's.



# from Kodak

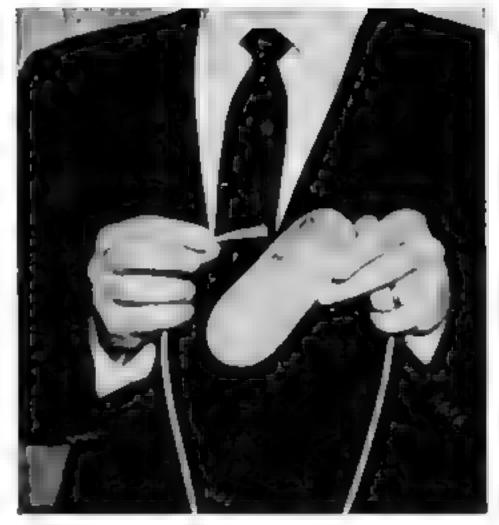
# Sensitized Photo Balloons Used in Diagnosis of Stomach Cancer

Rubber balloons coated on the inside with special Kodak photographic emulsion are being used with great accuracy to detect stomach cancer.

A patient is fed a tiny amount of radioactive phosphorus 32. Then he swallows an emulsion-coated balloon which is inflated until it is in contact with the stomach walls.

Cancerous tissues absorb more "P32" than normal tissues, and show up as darkened areas on the balloon when it is removed from the stomach and processed.

Knowledge gained by Kodak in creating such specialized products for medical, scientific, and industrial use, also helps produce finer films and equipment for amateur photography.



Dork areas on balloon reveal presence of stomach cancer. Kodak scientists worked for several years to develop a fast, flexible emulsion for the balloon coating. The balloons are now available to physicians.

See your dealer for

exact retail prices

# Versatile Slide Projector Lets You Use Any of 3 Changer Systems

This handsome new Kodak 500 Projector, Model B, puts the accent on versatility. It lets you choose any of three modern stide-change systems—fast-action Kodak Readymatic, Airequipt magazine, or Universal tray.

And it gives you great performance. The 500-watt lamp and big condensers show both 35mm and super slides brilliantly. The 4-inch f/3.5 lens gives big-screen images even in small rooms.

A quiet, turbine-type blower pulls cool air in over your slides and around the lamp. Elevation and focus knobs are on top for easy adjustment.

Handsome two-tone styling, Sturdy case cover

With Kodak Readymatic Changer and 4-inch lens, Kodak 500 Projector, Model B, is less than \$68, or as little as \$7 down. Ask your dealer to show you how smoothly it works with each of the changers.

Proces are subject to change without autre-

Kodak Readymatic Changer for card-board mounts.
Quickest from slide-box to screen.
Changer is versatile—handles card, glass, plastic or metal mounts

Kodak 500

in trays.

Airequipt Magazine Changer

stores each slide in a sturdy,

durable metal frame.

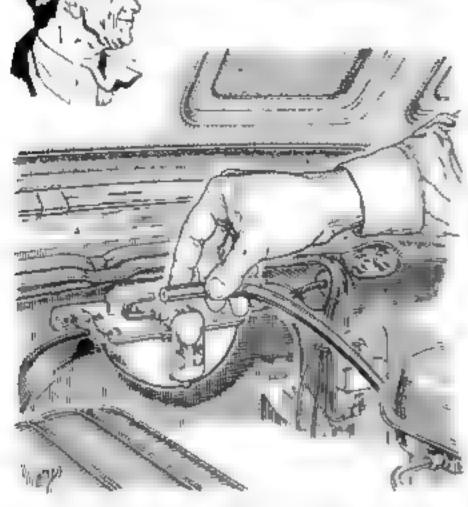
Projector,

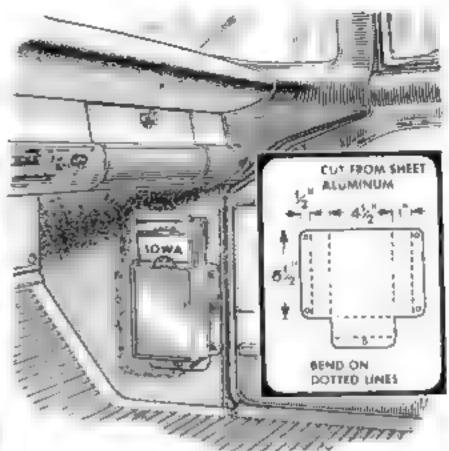
Model B

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

See Kodak e "Ed Su liven Show" and "Adventures of the Nerson Family "

# Hints from the Model Garage



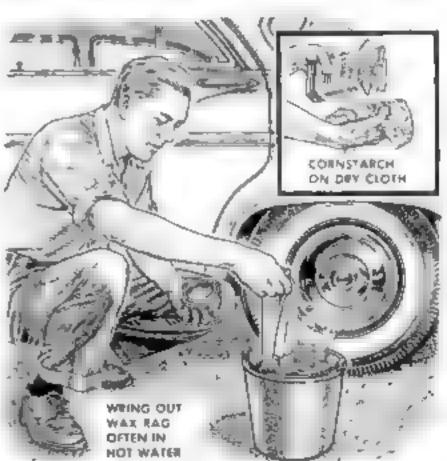


Next time you replace a wiper hose, use clear-vinyl tubing instead of the usual rubber hose. The vinyl won't dry out from heat or soften if oil gets on it. Also, if you see oil in the tubing, you'll know the fuel pump is going bad.

Store road maps in a small container screwed to the cowl paneling, and there'll be more room in the glove compartment. Cut the box from do-it-yourself aluminum sheet with household scissors. Bend it along the dotted lines.



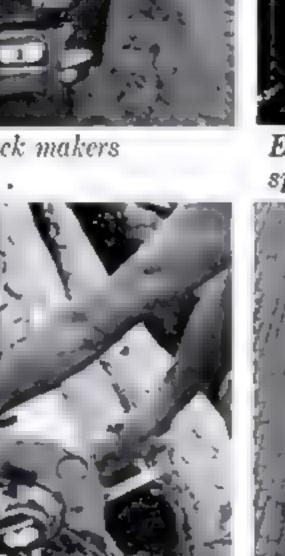
To avoid gouging concave surfaces with the edge of a portable disk sander, cut the disk into a square shape and mount it on the pad. Cutting action is lessened at the corners, yet the disk remains fully effective at the center.



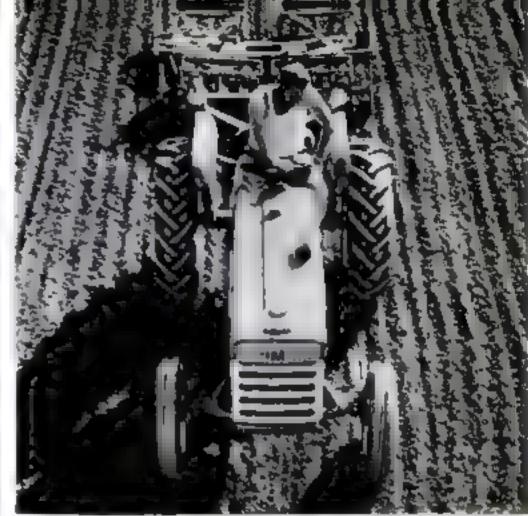
To take the work out of car waxing, wring the wax-applicator cloth in hot water often. The heat makes the wax easier to spread. Shake cornstarch powder on the cloth used for final polishing: It acts like a mild buffing compound.



17 out of 21 U.S. truck makers specify Champions . . .



Every major U. S. small-engine maker specifies Champions . . .



Every major U. S. tractor maker specifies Champions . . .



Over twice as many car manufacturers specify Champions.



Why are Champion spark plugs overwhelming favorites with men who design and build engines?

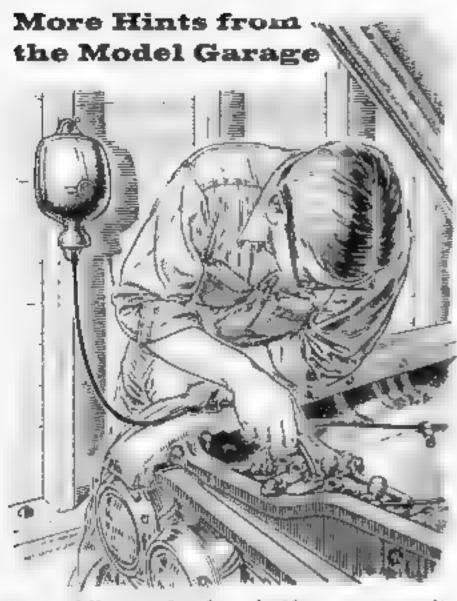


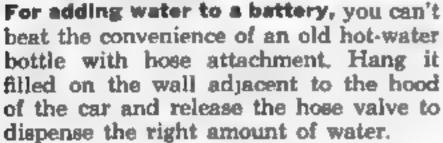
Because they know they can depend on Champions to deliver every bit of performance they've built into their engines. Your car will perform better (and save on gasoline) with new Champions. Put in a set every 10,000 miles!

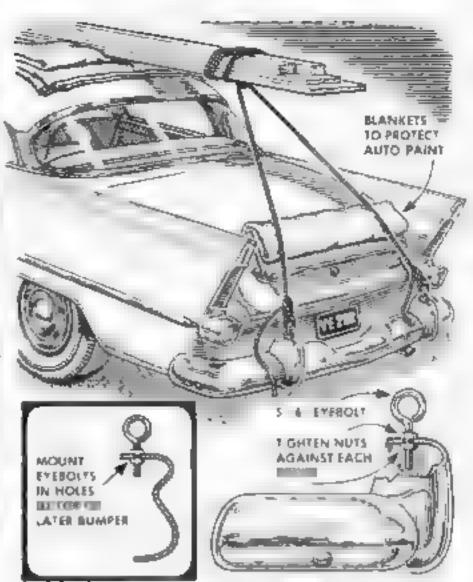
Worn spark plugs waste lots of gas so check your plugs every 5,000 miles!







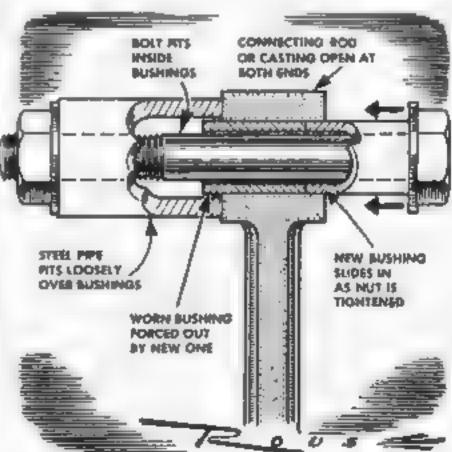




You can tie down loads hauled on the roof of your car safely and conveniently by installing eyebolts on the front and rear bumpers. Drill holes in the bumper or bumper guards and lock each eyebolt in place with two nuts.

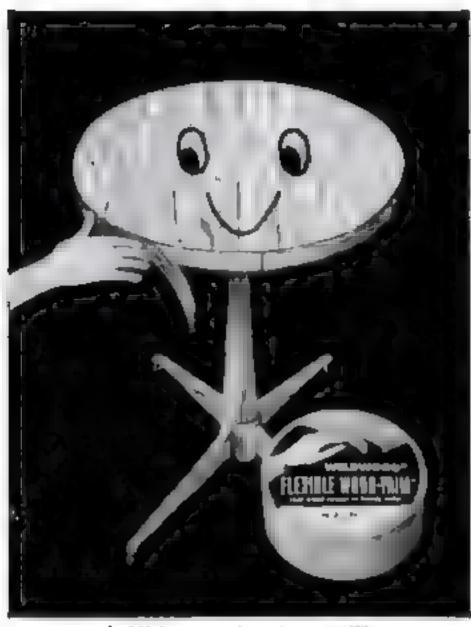


A look in a radiator can be stopped easily by completely filling the faulty core cell with metal-patching putty or epoxy glue. This won't affect the radiator's efficiency, and it's quicker than trying to locate and solder a pinhole.

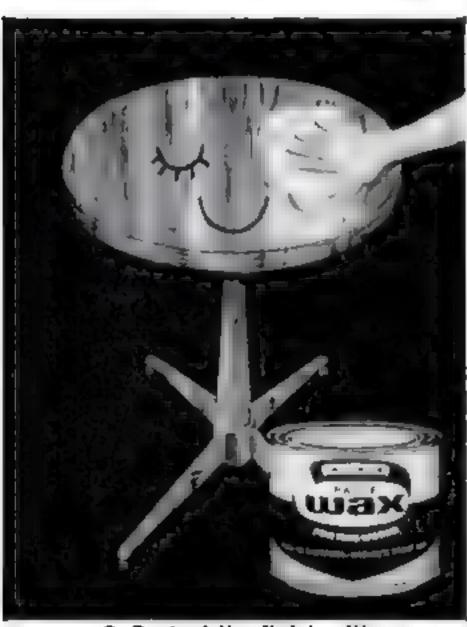


To install a new bushing quickly in any casting that's open at both ends, try the setup illustrated above. Tightening the nut causes the bolt head to pull the new bushing into the hole. At the same time it forces the old bushing out.

# 3 secrets of professional woodworking—by Weldwood



1. Hide rough edges with WELDWOOD FLEXIBLE WOOD-TRIM



3. Protect the finish with WELDWOOD PASTE WAX



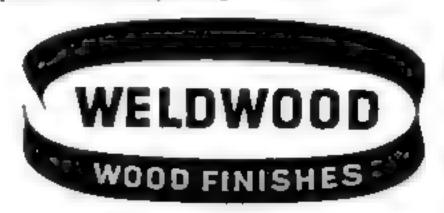
2. Bring out wood's beauty with WELDWOOD SATINLAC

weldwood\* Flexible wood-Trim\*, real wood, paper-backed, in handy 8' rolls. For edging plywood, lumber. Comes in 6 different woods. Apply with Weldwood Contact Cement or Presto-Set\* Glue.

WELDWOOD SATINLAC<sup>®</sup>, self-sealing finish gives glowing, soft-sheen fuster, brings out the wood's natural beauty without "plate glass" shine. For extra-light finishes, use first coat of Weldwood Satinlac Lightener.

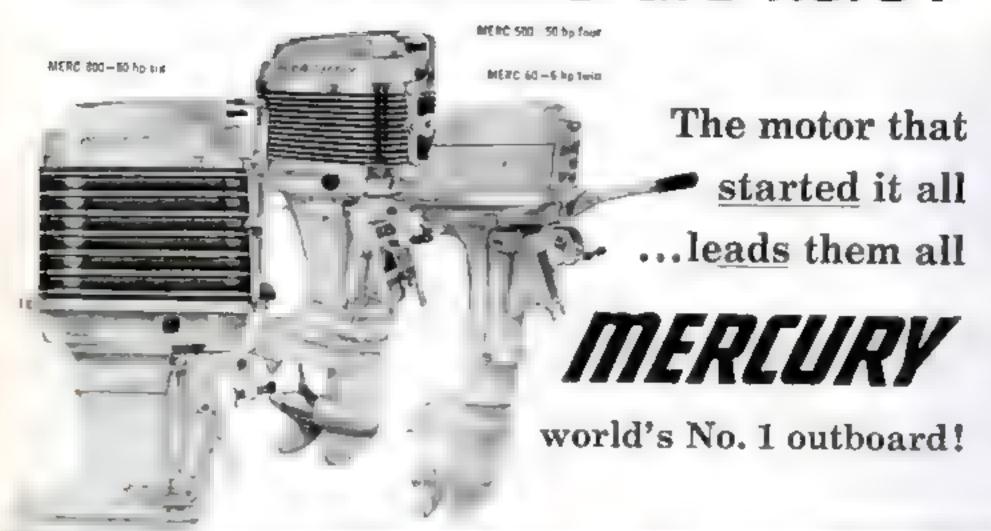
**WELDWOOD WAX** is a rich, high-carnauba paste. It's quick, easy, self-cleaning—puts the finishing touch on lasting wood beauty. Resists water spotting, won't harm wood, protects as it beautifies.

**wellowoop**—the people who know what's good for wood ... makers of world-famous Weldwood prefinished wood paneling.



Products of United States Plywood

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The industry's old heads had dismissed the idea of family outboarding, or of a market for motors larger than 7½ hp, when Mercury's "Lightning" struck its new concept: (1) More power, not less; (2) More compactness, less weight and bulk; (3) More durability, with slower-moving, smaller, tougher reciprocating parts; (4) More advanced engineering, using proved aircraft and automotive design principles. Mercury leadership helped boat builders design roomier, safer boats to make family outboarding a reality . . . helped to make water skiing a national sport.

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One lever, one hand, controls throttle and shift with running neutral in every horsepower class—8 to 80 hpt Exclusive with Mercury!





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# 80 hp MERC 800

WITH FULL GEAR SHIFT AND SIX CYLINDERS

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MOST ADVANCED OF ALL FISHING TWINS

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Outboarding's most proven fours start you water skiing and cruising! Full gear shift with running neutral, single-lever remote control. Shock absorbers available on Merc 400 and 500 to increase outboarding safety. One of the best outboard buys ever!

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Automatic transmission (Merc 200 and 100) combines forward-neutral-reverse shifting with twist-grip throttle. All-new Merc 60—lightest fishing motor for its performance—has full gear shift with forward-neutral-reverse lower unit. Twins feature; slanted design glides over rocks, through weeds; Jet-Prop drive; single-lever remote control, Ride-Guide steering available. The Merc 60 is the most modern of light outboards...a real honey!

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Kiekhaefer Corporation
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Gus Straightens Out an Average Driver

# By Martin Bunn

A LEAN, lantern-jawed, somberly dressed man got out of the station wagon at the Model Garage.

"Name is Kenquist," he told Stan Hicks. "I want the engine tuned up. It's sluggish. And lubricate the car, too."

"Yes, sir. Shall I change the oil?" asked Stan.

The lantern jaw set. "No! I want no oil drained, changed, or added."

"Sorry-lots of customers want an oil

change with a lube job-"

"I don't!" snapped Kenquist. "And I'm tired of people who try to sell me high-priced oil I don't need!"

"But I only-" faltered Stan.

"Have the car ready by five," said the

customer, and stalked out of the station.

Returning from lunch, Gus found Stan moodily busy. He'd lubricated the car; now he cleaned and regapped the plugs, set the points with a dwell meter, checked compression, and serviced the air cleaner. Only when he dropped the hood did Gus go over.

Gus listened to the smoothly idling engine. "Nice and quiet. Got us a new

customer, have you?"

Stan's face clouded. "Sort of a creep, Boss. Bit my head off when I asked ahould I change the oil, although it's black as tar on the dip stick."

"What's the last oil-change mileage

on the service sticker?"

Stan shook his head. "So help me, Gus, he's got lube stickers for 10,000 miles

back—but not one for an oil change. Maybe he pulls 'em off."

"It takes all kinds, Stan. Better do

exactly what he asked for."

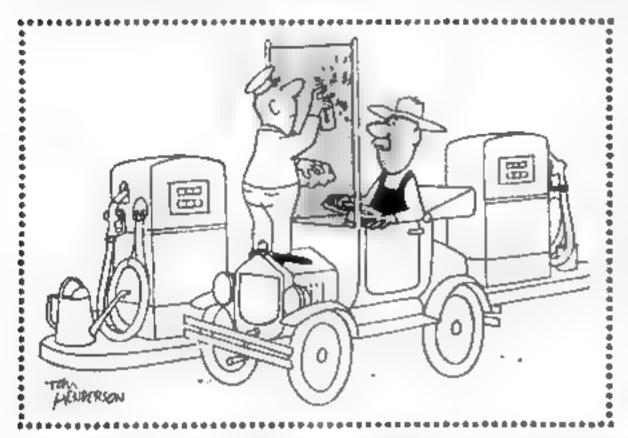
Stan nodded. "I did, but I wonder if it's what he needs? Maybe a road test—"

"Not necessary if you've done the work right," rasped a strange voice, as Ken-

quist appeared at Stan's elbow.

About to speak, Stan thought better of it. Gus turned away, uneasy but reluctant to interfere. He watched Stan make out a bill and take Kenquist's money. At first touch of the starter, the engine swung into a smooth idle

"Hope I've seen the last of him," mut-



tered Stan as the wagon slid into traffic. "But I've got a hunch I haven't."

I I UNCH or not, Stan was dismayed when the car rolled back in the next day, and Gus was again out

"It's still sluggish," rasped the lanternjawed driver. "I like to get what I pay

for."

"Sorry, Mr. Kenquist. If only you'd let me road-test it yesterday—"

"Do it today. And this time see that you find the trouble."

The somber figure stalked out. Stan proceeded to double-check point setting, timing, and carburetor-float level; made sure that the fuel pump and automatic choke were working right; installed a new condenser. As soon as Gus returned, Stan took the wagon out.

When he returned, his expression was so unhappy that Gus could hardly keep a straight face. "Same car, Stan?" "Worse—same owner," said Stan, flinging the hood up. "I've checked, tuned, and fine-tuned it. It idles fine, but at road speeds has a 1908 Maxwell's pep."

"How about valve clearances?"

"Gosh, no, this is the *quietest* engine—but I guess I better. Oh-oh!"

The cranelike figure of Kenquist shadowed the shop door. As he approached, Gus took the drop light and peered hard at the engine. Then he removed the dip stick to inspect the oil on it.

"That's not what I'm paying for," growled Kenquist. "I tell you I don't

need any oil."

"Seems not," said Gus. "That's only

a small leak as yet. "
"An oil leak? Where?"

"Around this valve cover," said Gus casually. "Shall we check the gasket and install a new one

if necessary?"

Kenquist nodded. With four eyes on him, Stan loosened the two valve-cover bolts. He grunted softly in astonishment as the cover seemed to rise under his hands. Gingerly he lifted it off.

"Wow! No wonder these valves were quiet!" mar-

veled Stan.

THICK black sludge merged push rods, valve springs, and rocker arms into one gooey mass. Kenquist stared.

"What's that stuff?" he asked.

"Sludge," answered Gus, "You do much hard driving, Mr. Kenquist?"

"None now. Used to, when I was a salesman. Now I only drive between home and office. Say, is this as bad as it looks?"

"Maybe not," said Gus. "But you can see why the valves couldn't work freely at high speed. We'll have to take down the engine, soak and clean parts, blow out oil passages, see if there are stuck rings or worn bearings. Come sit down while Stan checks a bit further."

"I don't understand it," said Kenquist as he sat down in the office. "For a year I've driven only around town. My trips average three or four miles each,"

"When do you change oil?" asked Gus. Kenquist colored, some of his aggres-

# Cardiograph of Power!



# Pre-ignition Meter Shows Superior Performance of ACs

This AC engineer is tuned in on the heart-beat of an engine. He's using a special AC pre-ignition meter to check spark plug performance. Here, the meter shows all eight AC Spark Plugs are firing perfectly. This electronic instrument senses the combustion chamber temperature in each cylinder. If dangerous, engine-damaging pre-ignition occurs, the temperature rises sharply. The

sensitive meter connected to the cylinder, records the change. The needle moves over to the danger zone. This is just one of hundreds of proving ground and on-the-road tests that AC engineers perform to make certain that the spark plug recommended for your car gives you the best possible performance. When you replace spark plugs... at 10,000 miles... ask for ACs and be sure.

AC SPARK PLUG 🤮 THE ELECTRONICS DIVISION OF GENERAL MOTORS



siveness returning. "The manual recommends every 4,000 miles of average driving. I did that when I was making long trips. Now I wait longer."

Gus's eyes widened "Because you

make only short runs?"

"Sure. Servicemen want me to change oftener, but that's oil-company propaganda. Oil doesn't wear out."

"Not while it's oil," admitted Gus. "But

what's that stuff in your car?"

Startled, Kenquist said nothing.

"Car makers," said Gus, "stretch the oil-change interval as long as they dare. The joker is that 'average driving' the manual mentions."

"Mine is even less than average."

"Funny thing," remarked Gus. "Every body thinks he's an average driver. But your kind of driving -the kind most people do nowadays--isn't average. It's

Kenquist's eyes narrowed for an argument. "You can't tell me easy trips are harder on a car than

long ones."

worse."

"I do," returned Gus. "Today's big engine is powered and cooled—for turnpike travel. On short trips it hardly warms up. The engine loafs,

but the oil is overworked."

"I don't see it," said Kenquist. "How

do you figure that?"

"For every gailon of gas it burns, your engine forms about a gallon of water," Gus explained, "Some combines with combustion gases to make acid. A hot engine vaporizes most of those wastes through the breather and muffler. A cold one lets more get into the oil.

"Automatic choking at every cold start shoots in raw gas. Some washes down the cylinder walls, dilutes the oil. Besides that, an engine running cool and rich forms more soot and other sludge makers."

Kenquist grunted. "If that's so," he said grumpily, "it's a wonder a car keeps running at all."

"Modern oils help," explained Gus. "They have additives that neutralize acids, disperse sludge, keep dirt in suspension. But they can't work forever. When those chemicals are neutralized, you have to dump old oil like dirty dishwater—and for the same reason."

"ALWAYS did want to take one of these engines apart," said Tom, standing beside his Volkswagen. "There are the pieces." He nodded at a boxful of conrods, push rods, cylinder heads, and other engine hardware.

"Don't forget to put back those eight pieces of wood you took out," re-

marked Pete.

"Wood?" asked Tom. "You kid-

"No. In every VW engine there are eight pieces of wood. They're in the box.

"There's nothing but ironmongery in that box," protested Tom. "You've got to be kidding."

"Only about forgetting to put them

back," answered Pete.

# .. How Come?

the toood is not seem, gine jobs, the rod ends are left on, so is placed in each channel. In most entened sides that allow the oil to pass, -toll coul tol income motions more in bnuor , siche bardwood stick, round finid might set up hounce by surging, large. But if this were full of oil, the rod teeight low, the channel is made feed oil to the rocker arms. To keep VASAER: THE bush rods are hollow, to

Stan came in, fastidiously wiping a wrench. "The lifters are all sludged up, too. Half the valve clearances are way out-they'd have been plenty noisy except for the gunk."

"I think we can promise you a livelier engine when it's cleaned up and readjusted, Mr. Kenquist," said Gus.

"Okay, I'm convinced. Go ahead."

"But you'll get sludge again," warned Gus, "unless you change oil much oftener for stop-and-go driving. In cold weather, I'd leave the heater off for short trips, to warm the engine faster."

"Guess I'll have to. No use paying you for a lesson if I don't learn anything

by it."

UCH relieved, Stan watched his diffi-M cult customer march out.

"With that personality, what could be sell? Dynamite?"

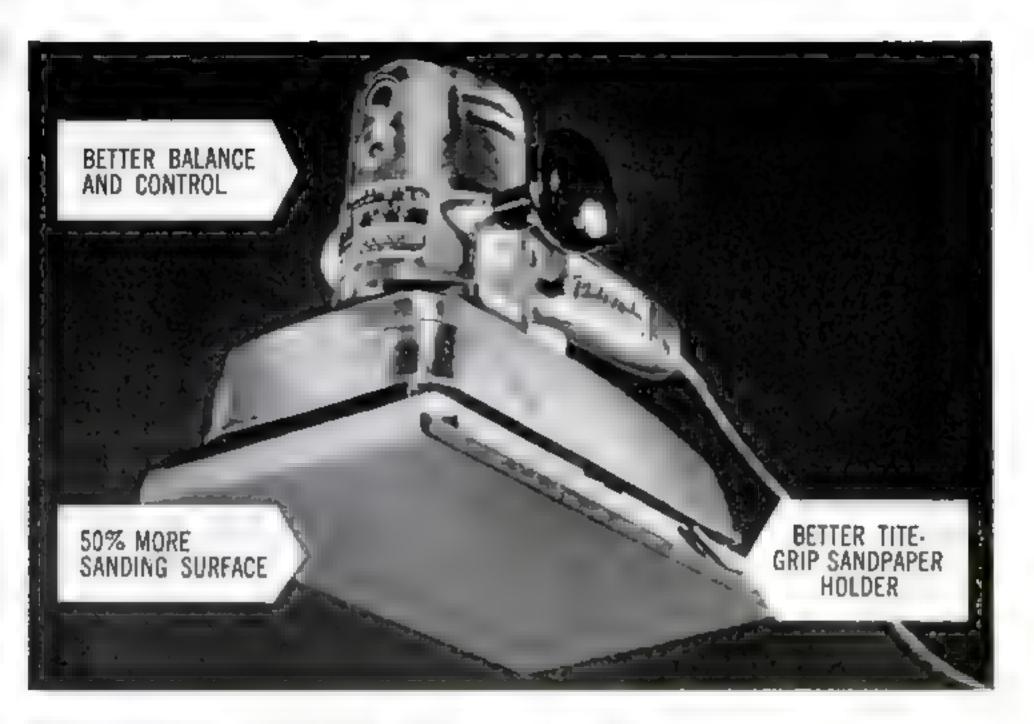
Gus chuckled, "Could be."

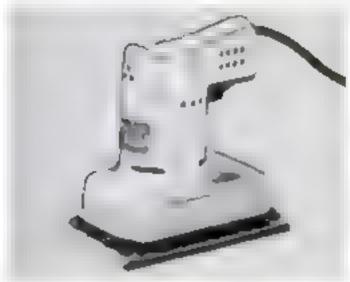
"He got more good advice than he deserved. Boss, if you keep telling people how to duck repair bills, what'll happen to our business?"

"Nothing. The law's on our side."

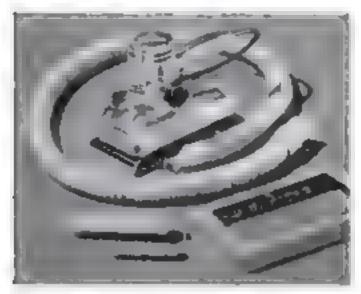
"Huh? How's that?"

"There are so many 'average' drivers," explained Gus, grinning, "that we can depend on the law of averages."





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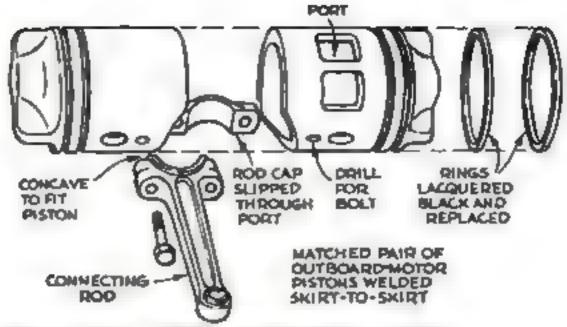
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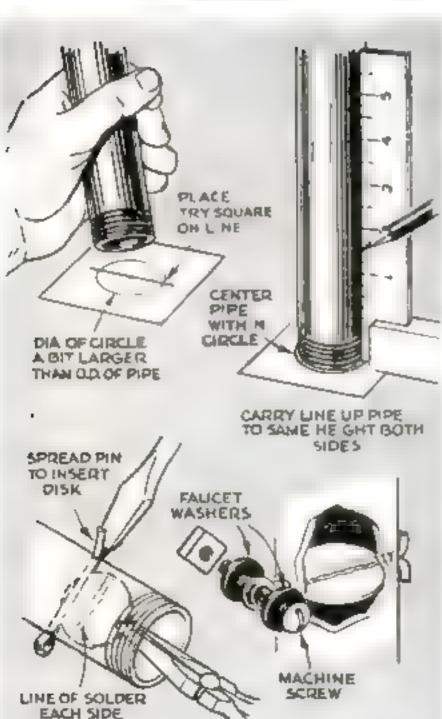






### Gavel from Outboard Motor Parts

WHEN the president of our Outboard Club needed a gavel for business meetings, we presented him with one appropriately formed of salvaged motor parts. It was made by bolting a connecting-rod handle to a pair of pistons that had been welded together, with the seam ground smooth. The rings were removed, sprayed with black lacquer, and slipped back in place over a paper sleeve to prevent scratching. Before the rings were replaced the rest of the gavel was gilded A decorative lanyard of 1/4" nylon line, spliced through the end of the handle, added a finishing touch.—Capt. Jeremiah B. W hittaker, Essex, Conn.



# Drilling a Pipe for a Damper

I NEEDED a shut-off in the 11/4" iron pipe connecting a second-hand heater to my car's defroster. A tin disk and a 2" cotter pin served for the damper, but I had no drill press and V block for boring two centered and aligned holes in the pipe. I drilled the holes independently, locating them with a layout on paper.

From a point on a straight line, I scribed a circle slightly larger than the pipe's circumference. I centered one end of the pipe in this circle and used a square to carry lines up the pipe where the line intersected the circle. Measuring up each line the same distance from the end, I established center points opposite one another. I laid a diameter line of solder on each side of the tin disk and ran a little solder along the pin before inserting it through the pipe. Centering the disk in the pin, I applied heat to sweat the pieces together. For a handle, I bolted washers to the eye as shown. -E. R. Hickman, Grand Rapids, Mich.

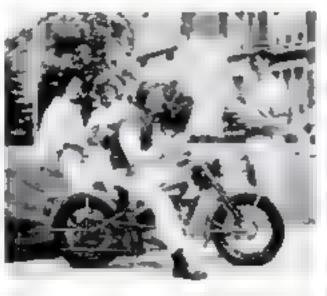
BUILDING workbench supports or tool stands out of pipe? Increase rigidity and cut down vibration by filling the pipe with cement.-Harry Ramsay, Jackson, Mich.

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### An Ail-Wood Home Typing Stand

This typewriter table can be finished to match your other furniture, avoiding the office look associated with the metal kind. The top is 27" above the floor, which is the normal height for typing. The top and drop leaf are 3/4" plywood. The other members can be cut from the same plywood panel or, if you object to

exposed edges, from 1" lumber (actual thickness about 3/4"). The back apron sets flush with the outside edge of the flanking legs but the front apron is recessed 3/4". Join aprons and rails to the legs with dowel joints.

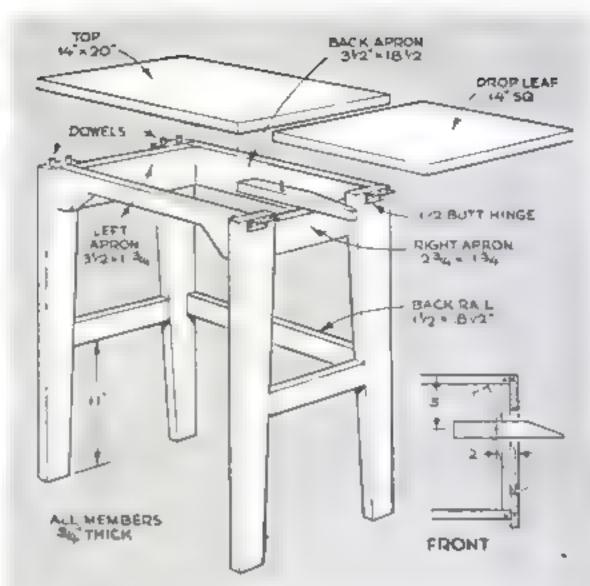
The side aprons are lapped and nailed: the one on the right is dropped to pro-

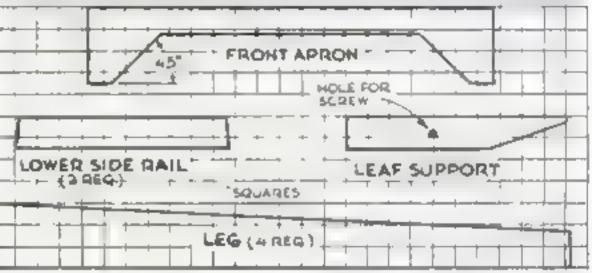
### Flanges Support Tent Poles

INSTEAD of putting wood blocks under the aluminum poles of my new camping tent to keep them from sinking into soft ground, I installed do-it-yourself aluminum floor flanges in the poles. The flanges are available at hardware stores



that sell aluminum stock. They come in three sizes that fit into 3/4", 1", and 11/4" tubing.-Ken Murray. Colon, Mich.





vide a slot beneath the top through which the leaf support projects. Outer faces and edges of the legs are flush with the edges of the top panel, which is attached to them by means of dowel joints. Glue should be applied to all butting surfaces, of course, before the parts are assembled. —D. E. Roetman, Dayton, Ohio.

▶▶▶BOTH horns on my year-old car went dead at once. I drilled out the rivets to open the housings and found that the trouble was rust. Each housing had an air vent at the top of the closed section to allow free diaphragm movement, Water could not drain out. I sealed the holes with metal putty and drilled new ones in the bottom of the housing. After cleaning the rust off and brightening the breaker points with emery paper, I reassembled the horns. Both worked fine.—Calvin N. LaFrence, Rock Island, Ill.



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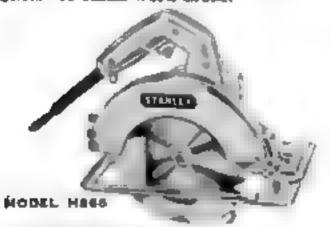
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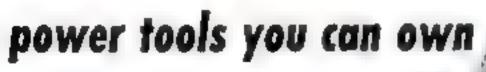


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### Square bottles for beer

"Prosit!" says the man as he pours beer from a new square bottle, introduced at the International Fair in Leipzig, East Germany. The maker claims that the square bottles take up less shipping space than round bottles. And they would enable Germans to store more of their favorite beverage in home refrigerators.



### Shrinking rings

These powdered-metal cores are the smallest and largest used in electronic filters. One at left is only 0.26 inch in diameter. The filters help guide missiles and speed long-distance phone calls by screening out interfering radio frequencies. Arnold Engineering Co. reduced one core from 4½ pounds to ½ ounce.



### 2,000-year-old tree

Tourists in the Union of South Africa flock to Tshipise to see this baobab tree on the farm of P. S. Vosloo. Believed to be 2,000 years old, the tree measures 65 feet around its massive trunk. Sight-seers have scarred it with carved initials. The baobab, valuable for timber, bears an edible fruit called monkey bread.



### Largest permanent magnet

Weighing 1,720 pounds, this Afnico V magnet will pump liquid aodium in an atomic breeder reactor to be operated by the Argonne National Laboratory. The electromagnet customary in such cases can't be used here because the metallic liquid will surround it. Some 500,000 ampere turns magnetized the giant.

# Tips from Weldwood-the people who know what's good for wood



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Seal and prime outdoor wood with WELDWOOD FIRZITE...



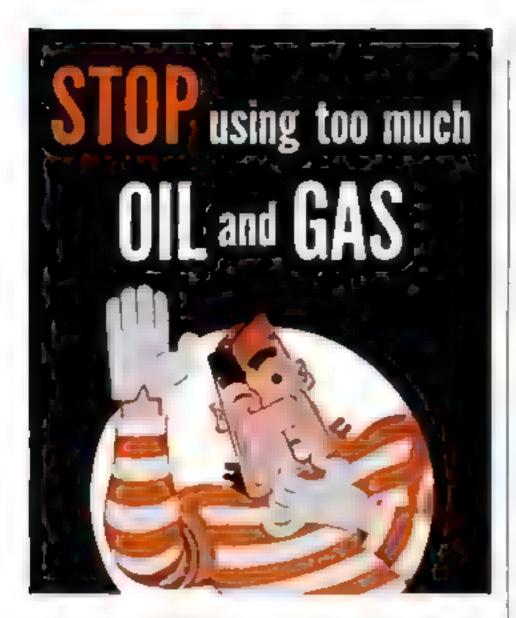
Protect and beautify outdoor wood with WELDWOOD SPAR VARNISH . . .

WELDWOOD WOOD PRESERVATIVE, essential where wood is in contact with earth, contains full 5% pentachlorophenol. WELDWOOD EXTERIOR STAIRS, 4 beautiful "woodsy" colors. Redwood, Driftwood, Cascade Green, Sierra Brown. WELDWOOD FIRZITE®, a penetrating resin-scaler for fir plywood, pine, etc. Comes in Clear to prevent "wild grain" in stain jobs; and in White, a pigmented prime coat to combat checking in paint jobs.

WELOWOOD SPAR VARNISH, durable, high gloss exterior clear finish that resists discoloring even in severe weather.



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on oil pumping
GENTLE
on cylinder walls





Oil Filters, Piston Rings, Cashte Additions,

# How Birds Find Their Way in the \$ky [Continued from page 100]

miliar with, that is 10-20 m.p.h. If weather emergencies come up, however, they can sustain higher rates.

A massive duck migration once awed watchers in the Mississippi Valley in the fall of 1955. Spurred by a broad severe cold front, thousands of banded ducks flew from central Canada to Louisiana in two days. The distances ranged

from 1,400 to 2,000 miles.

On the other hand, if birds find a particularly lush eating spot on the way, they often delay their travels. Far-West-ern ducks cause much havoc to rice fields that lie under their main migratory route through California. They spurn the enticements of federal and state refuges, convinced that nothing beats a water-laden field of rice. Farmers fight back with shotguns, sirens, and searchlights. Occasionally they even hire planes to buzz the birds.

Segregationists vs. fellow travelers. While ducks and geese stick to their own kind, a number of species flock together. Wood warblers will gang up with almost any other friendly birds. Blackbirds and swallows are equally tolerant.

Bobolinks and crows, however, are strict segregationists. Winter wrens and grebes, shrikes and belted kingfishers are fussier still. They won't even fly with others of their kind, but go it alone.

Similar variety exists in flying style and altitude. Ducks and geese are known for their rigid Vees. Barn swallows head south in flocks whose close-precision flying is as dazzling as that of the Navy's crack team of jet pilots. In contrast, bluebirds and warblers straggle like members of a crowd leaving a stadium.

Highest flyers are storks and cranes. Some have been spotted in the Himalayas at an estimated altitude of 20,000 feet. That would be impossible for most birds. The majority fly at around 3,000 feet or lower.

In clear warm sunlight when air currents are rising, day migrants (most of the insect-eaters) ride at their highest. The night travelers usually have no trouble avoiding obstacles. However, an unexpected meeting of cold and warm fronts in their path can produce appalling slaughter. As the colliding pressure areas spawn turbulence and low clouds, the

How Birds Find Their Way in the Sky birds are forced down until they are below the tops of skyscrapers and the tallest television towers. Though their eyesight is normally wonderful, they become confused and blinded by the blaze of cities beneath the clouds.

Air tragedy. On such a night in September, 1948, thousands of birds crashed into New York's Empire State Building. Their bodies rained on neighboring roofs and streets for six hours. That same night, flocks smashed into a lofty Philadelphia building and fell to the sidewalk so thickly that people couldn't step there. A similar catastrophe was occurring in Baltimore.

Over wide stretches of water, on the other hand, flocks of little land birds have been seen flying at a height of only 200 feet. Sandpipers travel hundreds of miles barely clearing the waves.

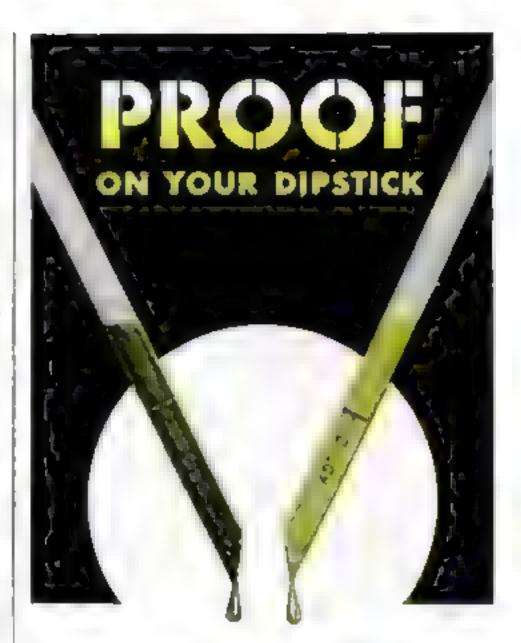
This man's-eye view of the bird world was clouded for thousands of years. Scholars often wondered where their feathered friends went in the fall, but the answers that occurred to them were odd indeed.

Aristotle said that birds hibernated in caves, hollow trees, and even under the mud of marshes. A giddier commentator, 20 centuries later, declared that they all spent their winters on the moon. Another writer couldn't guess where they disappeared to, but surely, he said, the big ones must carry the little ones on their backs.

And so it went, until banding records gradually made the fascinating picture clear. But even the old boys knew that wherever the birds spent their winters, they always came back in the spring.

The eternal return. As spring spreads northward from the equator, they all follow it, driven by the old biological urge to breed. Back they go over the same flyways, making the same stopovers, and, miraculously, often returning to exactly the same spot where they spent the previous summer. It's a sad commentary on marital fidelity among birds, though, that rarely do both mates come back to the scene of last year's liaison.

For the most part, the males arrive in the north first, find a place to raise a family, guard it stoutly, and sing their heads off—to make sure that the girls can't possibly fail to find them when they get there.



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Oil shows dirty? Dirt is abrasive and dirty oil causes wear. Get full-time protection—ask for Hastings Oil Filter Cartridges, and have clean oil from filter change to filter change.\*

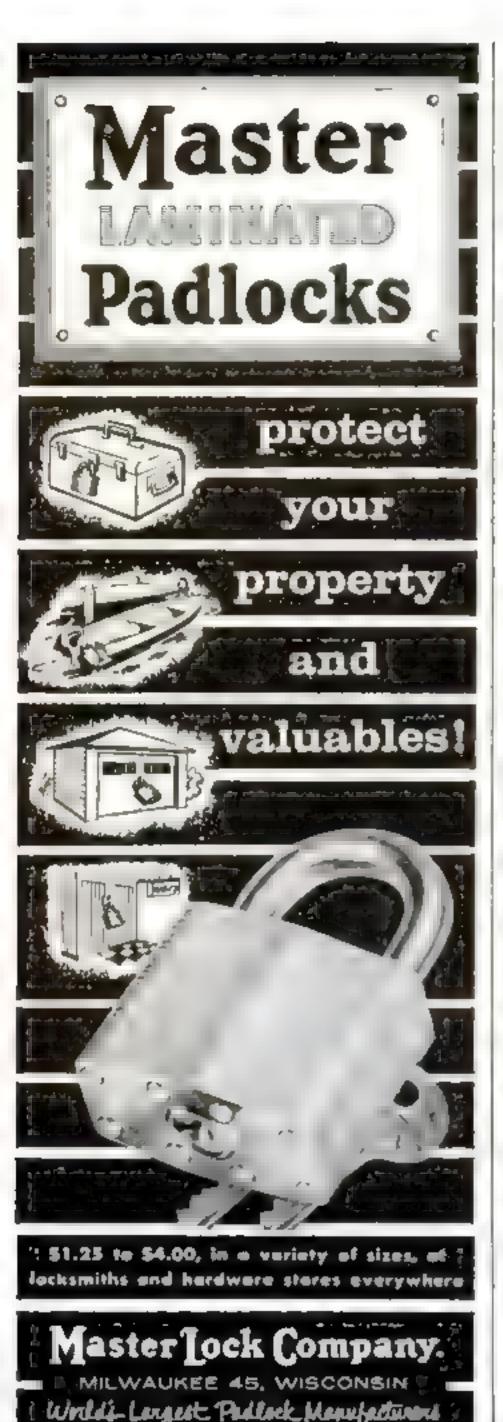
The Hastings Densite filtering material traps and holds all the dirt, even the most microscopic size particles. And, only Hastings has Densite.

Hastings Cartridges assure clean oil—less engine wear and less subsequent repair bills—as no other filter can. See for yourself... on your dipstick!

When replaced as normally recommended







## What Happens When You Black Out [Continued from page 114]

or when there are fears that must be denied. For example, people frequently pass out in doctors' offices when facing some minor procedure. They're afraid - but also afraid to express their fear since it may lead to ridicule.

What happens? With fear and danger, the heart accelerates and the blood flow to the muscles increases—for the purpose of action. But there is no action. And just standing there motionless, without doing or even saying anything, leads to pooling of the blood in the lower part of the body. The result is a fall in blood pressure, and a lessening of blood reaching the brain.

### What are other causes of blackouts?

There are dozens, some of them not well known:

- Blackouts often go with disease states such as strokes, epilepsy, poorly controlled diabetes. Barbiturate (sleeping pill) and other poisoning can produce them.
- Accidental contact with high-voltage electricity or even household voltages.
- Severe, prolonged coughing can produce a blackout by increasing pressure within the chest so much that blood flow there is retarded and less blood gets back to the heart. The heart then pumps out less, so the brain gets less.
- Overbreathing—which many people do under strain without being aware of it—brings in more oxygen but also gets rid of too much carbon dioxide. When the carbon-dioxide level in the blood falls far enough, brain centers are affected.
- Holding the breath, on the other hand, can produce unconsciousness by building up the level of carbon dioxide; in high concentration, it becomes an anesthetic. Recently, several cases where expert swimmers drowned during attempts at prolonged underwater swimming have been traced to breath-holding
- Many mysterious bathroom blackouts have been traced to a combination of breath-holding and straining during elimination. This can change the heart rhythm so that less blood gets to the brain—sometimes enough less to produce unconsciousness.
- And lately, even TV watching has turned out to be a cause of blackouts.



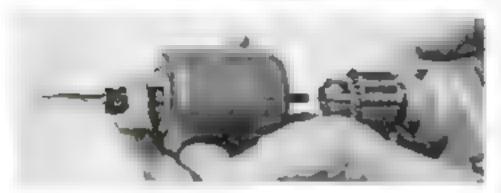
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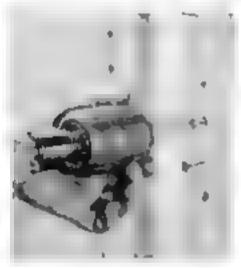
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PRECISION ASK PRODUCTS

What Happens When You Black Out The flickering light produces a kind of epileptic attack in sensitive persons.

# How can you determine why somebody has passed out?

With so many possible causes, it's not always easy. Sometimes a quick search of the immediate surrounding area will disclose an electric-shock hazard, whisky bottle, or empty poison container. There may be evidence of injury, particularly about the head. If the pupils, the black center spots of the eyes, are unequal in size, there is a possibility of stroke or brain concussion. Blood-tinged saliva or frothy lips mean an epileptic fit.

Is the victim's face red, white, or blue? It's likely to be one shade or another.

White unconsciousness most often is due to simple fainting. Other possible factors include hemorrhage and shock.

In red unconsiousness, strokes and skull injuries are most common causes.

Blue unconsciousness indicates asphyxiation or near asphyxiation.

These are just rough guides. It may take a skilled physician to pin it down.

### Can you prevent a blackout?

You can often avoid fainting if you know the warning signals—ringing in the ears, blurring of vision, paleness, beads of perspiration on the forehead, and a feeling of weakness. Lying down—or bending forward at the waist and putting the head between the knees—will get more blood to the brain.

# What can you do to help an unconscious victim?

Lay him down and loosen his collar.
If he's blue and breathing is absent,
send for a doctor and start artificial respiration at once. And keep at it.

If he's red, raise his head slightly and get a call in for a doctor. Give no stimulants—give nothing by mouth while any victim is unconscious. Cover his body to keep him warm, and apply an ice bag, or cold, wet cloths, to his head.

If it's white unconsciousness, lay the victim down with the head slightly lower than the rest of the body if possible. A roll of clothing under the hips will help. Hold aromatic spirits of ammonia, if available, under his nose—but not if you see any signs of a skull injury.

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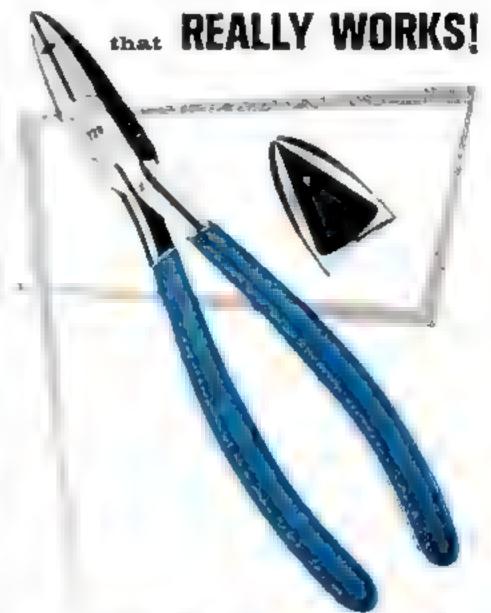


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Tokyo to Carolina in 121/2 Hours
[Cantinued from page 130]

(Joe Blaylock left the pilot's seat for

only brief moments.)

First landfall. Following a Great Circle route, we struck out across the North Pacific, passing quite close to the Russian-held Kuril Islands. We crossed the international date line, and about 20 minutes later (and 2,000 miles out) made our first landfall; a little group of blobs in a gray arctic sea. These were the Rat Islands, part of the Aleutian chain.

Trask's pessimistic prediction earlier about tail winds seemed destined to be true. There was no wind at all, on the tail or elsewhere. The ground-speed needle stayed on 500 knots, hour after hour. Capt. Blaylock was using his "Machhold button," which caused the airplane to climb automatically from our original 33,000 feet as it burned its fuel load.

"I can't use this button when I'm flying an assigned altitude under FAA control," Blaylock said. "But out here there's
really not much danger of a mid-air
collision so we can slide uphill. The button holds our speed constant—and as we
burn light we gain altitude. We're hoping,
of course, to get up in a nice fat jetstream. We're at 38,000 right now."

The flight was enlivened from time to time by the "dump valve" releasing over-pressure from the cabin. It was an explosive pshhchewwwl sound that brought me straight up each time I heard it until McKissack explained it was harmless.

"Better than the fuselage busting out like an inner tube, hey?" he said.

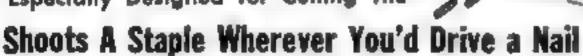
Nature's freezer. Each of us had three flight lunches and the cabin was soon a shambles of picked-over sandwiches, eggshells, and empty milk cartons. McKissack showed me how to cool the tomato juice. You stick it in the crack of one of the emergency escape hatches next to the skin of the plane (the air outside is minus 65 degrees F. and rushing past at 500 knots, which gives it a chill factor of about a zillion). There's only one drawback to McKissack's method: If you leave the juice there too long you bring back a rock-hard cylinder of tomato ice.

The sun swung around, low to the south at all times, and finally sank into the sea. A period of afterglow set in. I was sitting in the jump seat at the time, and presently felt a nudge and twisted

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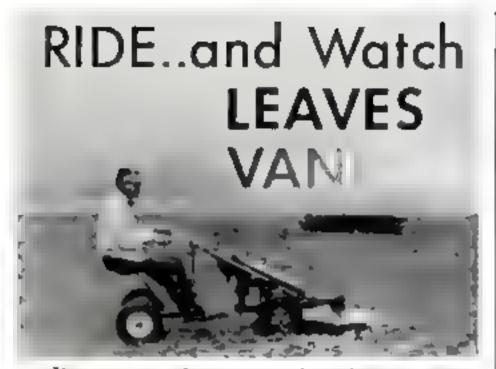


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### Tokyo to Carolina in 121/2 Hours

around to find John Trask. He pointed.

Ward and his boys were staring at the ground-speed indicator. It had come unstuck. It now stood at 510 knots.

"Jetstream?" I asked Ward.

"Can't tell yet."

I watched awhile, and the needle gradually eased up to 520 knots, and I lost interest and peered over Joe Blaylock's shoulders through the windscreen. It was a spectacular sight. Stars were beginning to burn in the apricot flush of the afterglow. The cloud-deck, 30,000 feet below, stretched off to the rim of the world, white as cotton. The night was coming on from the north, a great steel-blue shadow dropping down from the pole. The big jet seemed to boat along over the cotton sea, gently, almost softly, the noise of the jets far removed, the relative motion sedate and leisurely at this giant altitude.

Behind me, somebody said excitedly, "580 knots! It's a jetstream, all right . . . "

To Scattle like a bullet. The plane was now beginning to wallow and buck as the ferocious wind tunnel in the sky into which we'd atumbled whipped over our skin. Everybody was awake, rooting for the jetstream. And their hopes were rewarded. We finally stabilized at a ground speed of 740 m.p.h., which brought us in on Seattle like a silver bullet. Seattle defense radar challenged us about this time.

"Departed Yokota Air Force Base, Japan," Lynn Dyes said from the copilot's seat. "Destination Seymour-Johnson Air Force Base, North Carolina."

There was a startled pause below. Then the voice said, in a somewhat awed tone. "You people wouldn't be trying for a speed record, would you?"

"Yes," said Dyes. "We would."

"You keep on like you're going," defense radar said, "and you sure ought to make it. We're painting you at 738

miles an hour right now."

But almost as quickly as it had risen, our speed dropped as we left the jetstream over the continental U.S. The excitement died. Saucy Sixty's bushed passengers curled up like pretzels and tried to get comfortable among the piles of luggage, spare tires for the KC-135, and other gear lashed in the middle of the cabin. I squeezed into the jump seat behind Blaylock and waited for the

### Tokyo to Carolina in 121/2 Hours

dawn. It came up on the left like a paleblue spotlight in a black-velvet sky pricked with stars. The blue color changed to dirty white. The stars faded. Then the sun edged over the rim of the clouds, and for a moment or so the entire sky to our right was shrouded in delicate orchid reflections. Only for a moment. Then we were staring into the eye-splintering glare of the naked sun.

Victory fly-by. We called Lewiston, Mont., for Seymour-Johnson weather. No problem, we were told. We bored diagonally across the face of America—lowa, Illinois, Ohio—and when we looked down through a hole in the clouds and saw Cincinnati, Joe Blaylock started a very gradual let-down for a landing. He knew we were going to break the unrefueled speed record for a flight of this length and he had asked for (and received) permission to do a victory fly-by over the small crowd of friends and wives who

would be waiting on the field.

That fly-by was very nice. I was standing up in the navigation compartment (just behind Blaylock) and saw him push the nose down and heard the engines hoot to full military power as the big jet tanker tore low over the waving welcomers, turned steeply and smartly on the base-leg of the landing pattern, and settled for a perfect grease-job (Blaylock Specials, the crew calls them).

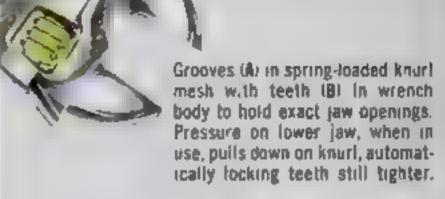
A few moments later we were standing on the concrete, stretching and blinking. Mrs. Blaylock and Joe's kids were just a few steps away. I'm not sure whether Joe kissed his wife first or picked up his boy first. Maybe he did both at the same time. Behind me I heard somebody say excitedly, "Twelve hours and 32 minutes over the field. That's 573 miles an hour for the full trip."

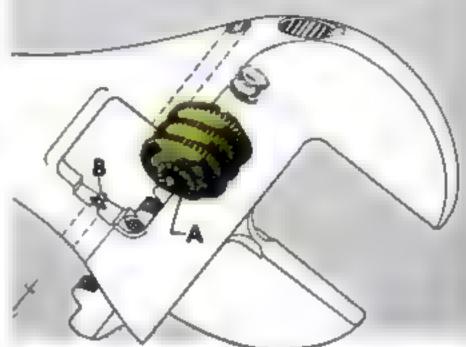
I looked around. One of the GI passengers was standing there. "How long was the full trip?" I asked.

"Just 7,175 miles. We beat LeMay's time from Tokyo to Washington by a nice margin." The GI grinned. "As a matter of fact, we got here an hour and a half before we took off."

He was right. We had left Yokota at 0930 Tokyo time, June 15, 1960—and we had arrived at Seymour-Johnson Air Force Base at 0806 Eastern Standard Time, June 15, 1960.

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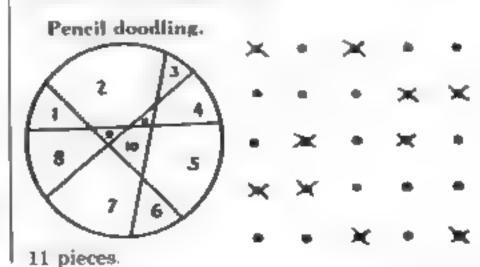
The suitors. All three have marks, Here's why: Suppose only one, A, has a mark. Then B and C would both raise their hands and A would not. Then A, who can see that B and C are without marks, would automatically know he must have one, and quickly announce this fact to the king.

Now suppose two out of three have marks, say A and B. All three would have their hands raised. From A's point of view B has a mark, C doesn't. Yet B has his hand raised That can only mean that he, A, must have a mark, and he too would quickly call out to the king. (B could reason the same way, obviously.)

However no one makes this quick deduction: we are told there is much cogitation. The only possibility then is that all three have marks, and the first man who perceives this does indeed deserve the princess's hand.

Ping-pong. Jim held the ball down in a saucepan of hot water. The water pressure being negligible, the heat of the water caused the air inside the ball to expand and push the dent out.

Chess. No matter how you put a domino down to cover two squares, one of the squares will be red, one black. But the diagonal corners that have been removed are both red That leaves two more black squares than red ones left. After 30 dominoes have been put down on the board there will still be two black squares left which can't be covered by the one remaining domino.



### 850-Mile Drive in a Buick Special

[Lantinued from page 91]

rating Michigan's upper and lower peninsulas, we went to a drive-in movie. I switched on the headlights. No dice.

"Hmm," said Wurtz, down in his throat. He sat there beside me for a long minute, thinking. Then he got that huge bulk of his down on one shoulder under the left side of the panel. In a minute the headlights blazed on

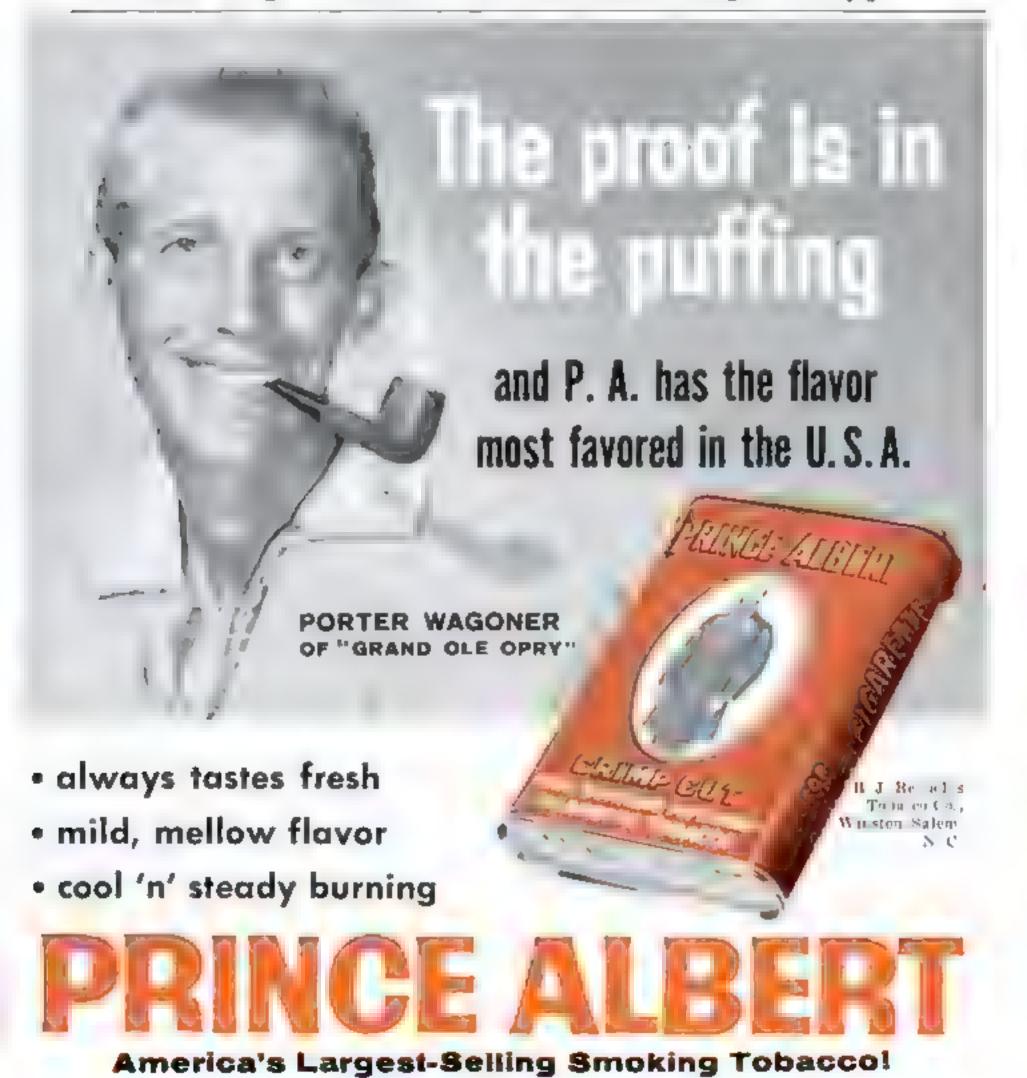
"Bad connection at the dimmer switch."

The next day we headed home, leaving much of Michigan with a Wurtz-created food famine. We got a late start on our 234 miles to Flint, and I had a midafternoon airplane to catch.

"Let's roll it," said Wurtz.

At least half our route was wild, deer country. We rolled it, gluing the speed-ometer needle to a legal 65 miles an hour. We refueled at 1,241.7 miles. We had gotten 22.6 m.p.g. for 219.2 miles.

But now we hit headwinds. The gusts were so hard at times that they shook us. On our final refueling, at 1,446.6 miles, we sponged up 10.9 gallons for 18.8 m.p.g. Our overall average: 20.3 m.p.g.



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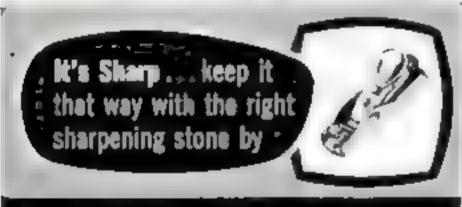
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235 POPULAR SCIENCE OCTOBER 1960

### How Those Political Polls Work [Continued from page 135]

vote, when tallying the results of the survey.

How can the poll takers tell in advance who will vote and who won't? Read tea leaves?

It's not as bad as all that. However, the laws of mathematics have to be replaced by the much less certain science of psychology.

The surveys ask questions that rate each person's intention to vote. For example:

Which of these statements best expresses your feelings?

1. I definitely will not vote.

2. I don't plan to vote, but I might. 3. I'm not sure whether I'll vote or not.

4. I expect to vote, but I might not. 5. I am certain to vote (barring some accident).

Which of these statements do you agree with most?

 It won't matter who is elected. 2. The differences between the candidates could affect the future of the country.

3. This is one of the most important elections ever held.

Any person who answers the first question with No. 5 and the second with No. 3 is a sure bet to vote. His preference would be counted. Anybody who replies to both questions with No. 1 is unlikely to vote. His preference could safely be thrown out.

Most people fall between these extremes. So each answer to several questions is assigned a numerical weight. The total score for each individual determines whether he will be counted as a voter or excluded as a nonvoter. The survey directors decide which score means what. This involves judgment, akill, experience—but not much mathematical science.

Okay, the nonvoters are winnowed out, But how do the pollsters know the others have answered truthfully? Don't people lie sometimes?

People give false answers when they don't like to admit the truth to them-

### How Those Political Polis Work

selves. Many surveys produce inflated statistics on education—more people say they went to college, or graduated from high school, than could have done so. (There are other records that can be checked.) And surveys conducted immediately after an election turn up 80 percent "yes" answers to the question "Did you vote?" (The actual turnout never reaches 70 percent).

Face-saving falsehoods could mislead an election survey, as they apparently did once in California. At issue was a very expensive plan for old-age pensions. The survey found only 25 percent in favor, but in the election 45 percent voted for the plan. Evidently many people could not admit, even in confidence, that they might approve "heavy government spending." (Some critics blame such discrepancies on sloppy sampling technique rather than untruthful answers.)

When self-esteem is not threatened, nearly everyone gives frank information on the most private matters. Those who are unwilling usually take refuge in evasion: "I don't know," or "I haven't decided."

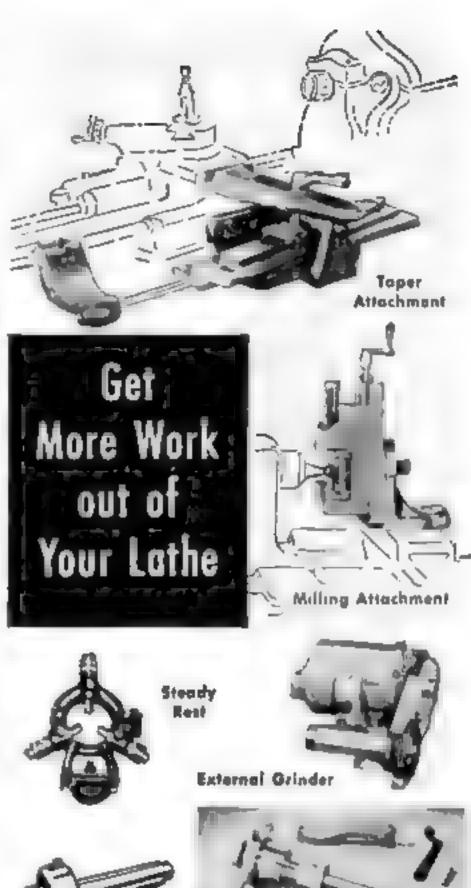
That still leaves the surveys shaky. If many people lie, or are undecided, wouldn't the whole thing come out wrong?

The pollsters make up the undecideds' minds for them, and predict which way they will vote.

There they go, reading tea leaves again! If a man says he himself doesn't know which way he will vote, how can the pollsters know?

Same way they predict whether or not he will cast a vote. A series of graded questions probes for concealed opinions. Typically, a man might be asked to rate the performance of the outgoing administration (excellent, good, average, fair, poor) and then to list famous men in the order of their ability. If he rated the administration excellent and listed its leaders first, it wouldn't be hard to forecast his vote.

The same graded questions are a backstop for catching false answers. If many people claimed to prefer Candidate A,







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Any other ways surveys can go wrong?

Yes. Surveys are not elections and their results must be interpreted cau-

tiously, remembering that

1. The inescapable margin of error makes close decisions dangerous. One survey last summer had Kennedy with 52 percent "leading" Nixon with 48 percent. That's stretching things. If you allow plus or minus four percent for possible error, which is optimistic, you get somewhere between 48 and 56 percent for Kennedy, somewhere between 44 and and 52 percent for Nixon. The true figure for the whole country could fairly easily have come out 52-48 with Nixon ahead. From that survey you couldn't safely conclude anything except that the race was close.

2. Surveys forecast the popular vote, but presidents are chosen by the Electoral College. It is possible for a candidate to win the majority of the popular vote and still lose the election. That has happened twice (1876 and 1888).

3. Surveys gauge public opinion before an election. People can change their minds in the last few days. To catch last-minute switches, Gallup and Roper now run final surveys ending the Saturday before election day.

With so much human judgment involved, and so many chances for error, why should anyone believe the surveys at all?

Because they're skillfully and honestly conducted on sound principles—and they have a fair record for accuracy. The Gallup Poll has only once been as much as 6.8 percent off in predicting the vote in the past 11 national elections. It picked the wrong man to win once (1948, with 48 percent error in the vote).

Dr. Gallup says that he knows only two things for certain about election polls. One is that they are bound to pick the wrong side some time in the future. The other is that they are better guides to elections than any other method now

available.

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Lots of folks are inclined to skip over the important step of "polish sending" - fine sanding or rubbing between coats. Then they wonder why they don't get that true professional look to their job.

In the photo, dried bubbles and trapped particles are cleared away by hand rubbing with TUFBAK DURITE Paper Sheets, Extra Fine grit 320-A, using water or oil as a lubricant. Fold a standard 9" x 11" sheet twice to make a convenient pad.

In another instance, the first liquid cost on bars wood tends to curl up numerous surface fibers, resulting in stiff rough nubs. Use the same 320-A TUFBAK, dry or with lubricant, on a handy BEAR Sanding Block. Of course, repeat the polishing between additional coats.

Remember for your preliminary rough sanding, use BEAR ADALOX paper for a quick, easy job. ADALOX sands much faster than ordinary sandpaper-cuts down on the uninteresting part

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### When Will We Start Burning Water? [Continued from page 106]

building of new water-burning engines. In experimental reactors, these bared particles are shot through the chamber at speeds of thousands of miles a second in the hope that enough of them will merge to keep the "fire" going, and the greater the heat, the more the powergiving mergers. It is something like burning wet wood—if the fire is hot enough,

you can do it.

But heat is only a whip to speed up the particles; the big idea is to smash enough of them together to get sustained fusion. If you get them down the track fast enough, you can give or take a few million degrees and it won't matter. Such uncertainties lend a fine sporting spirit to

the whole enterprise.

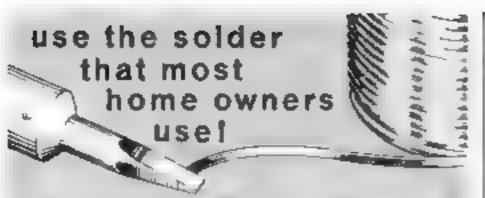
Most American work is grouped under Project Sherwood of the AEC and performed in laboratories at Oak Ridge. Los Alamos, the University of California, and Project Matterhorn at Princeton University. The AEC also finances projects at eight other universities, and more work is being done at the Naval Research Laboratory in Washington and by several large corporations.

One of the most spectacular new experimental fusion engines is the "Stellarator C" now being built by Matterhorn in a 70-acre field near Princeton at an estimated cost of 34 million dollars. The newest and most hopeful of a series of "oval racetrack" devices, it is the concept of Prof. Lyman Spitzer Jr., Princeton astronomer, who has been working on the

plan for nine years.

Three 90-ton flywheels will store the energy of big electric motors and deliver it in short bursts of enormous power. Some day next year a charge of deuterium atoms will be kicked around an 8-inch tubular oval, 40 feet to a lap, at a hoped-for temperature 10 times that of the center of the sun. A staff of more than 100 scientists and engineers are busy outwitting the gremlins and hoping for a big stride toward a workable engine.

"This plant is only a laboratory," Dr. Melvin B. Gottlieb, Matterhorn's associate director, explains cautiously. "It is not designed to produce useful power. No one yet knows how to build a fusion reactor, and no one knows if it can be made to pay. Everyone knows you can



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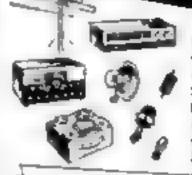


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When Will We Start Burning Water? get gold from sea water, but it costs too much."

Meanwhile, sharply competitive teams throughout the world are building about a dozen other experimental machines with equally high hopes and cautious predictions. Everyone has run into unexpected trouble. Six years ago the British built a doughnut-shaped device named Zeta. The first tests in 1957 seemed promising. Then they were dismayed to find that they were not getting results that would lead to a practical plant. Now the British are testing various designs.

The world's biggest machine, Russia's OGRA, has a straight cylinder so big that a man can walk through it. It doesn't work because of a newly discovered "revolutionary movement among the electrons," reports Dr. B. A. Trubnikov, who believes they can be controlled in a monster tube about 35 feet in diameter.

Many U. S. scientists are skeptical about giant devices at this stage, and believe faster progress can be made by testing a variety of smaller gadgets. Dr. James L. Tuck of Los Alamos, who years ago named his first crude device "Perhapsatron," announced early this year that he had reached the goal of a "true thermonuclear reaction" in a device called Scylla, which heats a blob of plasma the size of a robin's egg to 13,000,000 degrees for about 7/1,000,000 of a second. Although other scientists challenge his statements, he is working now on a bigger reactor.

At the Livermore branch of the University of California Radiation Laboratory, another team pins discreetly qualified hopes on a straight-tube reactor with "magnetic mirrors" at both ends, which contain the particles by batting them back and forth. Preheated charges of the fuel are injected in pulses, then compressed by the magnetic field to the heat of fusion, somewhat as in a diesel engine. Oak Ridge and the Russians are experimenting with variations of this idea. At least six different approaches will be tested in the United States within a year.

If and when all problems are solved, how will such an engine be used? Prophets foresee tremendous electric power

When Will We Start Burning Water? plants—the bigger, the more efficient located near bodies of water from which they will extract their fuel. There will be no danger of using up all the heavy water in Lake Michigan, for instance, for streams and rainfall would constantly renew it. Fusion-power plants, the prophets say, will never be suitable for small installations, remote villages, or mobile equipment: but when the world's oil is exhausted, they may charge long-lived batteries to run electric automobiles.

It may be that the first fusion plants will use another kind of fuel-deuterium mixed with tritium, a triple-heavy hydrogen atom that is fantastically rare in nature. It is highly radioactive stuff made by the AEC for use in the H-bomb, and costs about \$500,000 a pound. This fuel mixture would react at much lower heat than deuterium alone, minimizing many problems. Tritium can be made by bombarding lithium, and if the reactor were encased in a blanket of this metal. it would "breed" more of the costly fuel than it would use, thus more than defraying the cost of the original charge. Professor Spitzer once drew up plans for a hypothetical plant of this type, and calculated that construction costs would be within reason, and that it should make electricity at about the price of today's coal-burning plants.

Target date? No one can predict when practical fusion power plants will start operating. The tough-minded Dr. Teller puts it like this: "The question is whether we will burn rocks or water when our coal and oil are used up. I am confident that we will eventually burn water, but you have to fly kites before you build planes. I tell builders of today's atomic plants that they needn't worry until about the year 2000. By that time, fusion power may present strong competition. Of course some clever person may devise a more effective plan that will speed up the program, but if anyone thinks he can burn water in 10 years he is probably mistaken."

Many fingers have been burned since experimenters at work, someone may hit

the great idea was first conceived, and pessimism is in style; but other scientists are brash enough to believe in a shorter time schedule. With many determined the jackpot.



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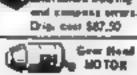


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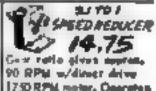
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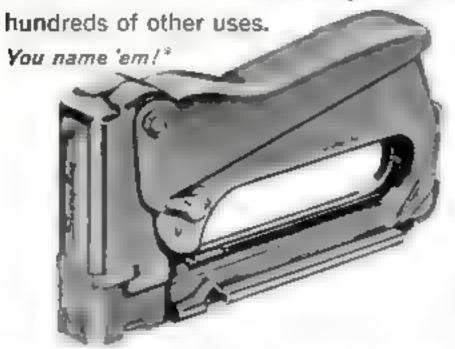


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### Buick, Olds, Pontiac Go Compact [Continued from page 76]

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Transmissions. To provide automatic shifts for the BOP cars, the engineers adapted standard machinery. They lightened and simplified it—and then worked in some cute new tricks,

The Buick Special's automatic is a torque converter with gears, like the big Dynaflow. The new idea is torquesplitting. Above certain speeds, which vary with the throttle opening, a clutch routes 37 percent of the torque directly through gears to the output shaft. This 37 percent bypasses the converter. The rest of the torque goes to the converter to be multiplied, then to the gears,

The Olds F-85 automatic has three speeds forward (instead of the four on the regular Hydra-Matic). And it has something Olds salesmen will call "Accel-A-Rotor." This gizmo is a torque multiplier that changes the transmission ratio in first gear. You start up with a numerically high ratio, 3.64:1, for getaway, But then the ratio automatically decreases to 3.03.1—just when depends on throttle opening—before the transmission drops into second gear. You blast off from the stops, yet gently ease toward cruising.

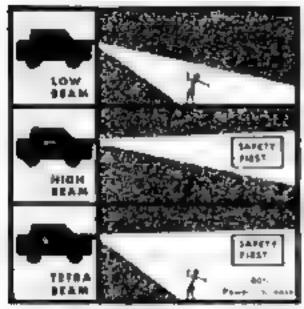
The Tempeat's automatic transmission is a torque converter with planetary gears, like the Special's. But this gearbox not only splits torque, it is split itself. The gearing, pumps, and clutches fit in a housing ahead of the differential. The torque converter rides behind the differential, Concentric shafts run through the differential, joining the two parts of the transmission.

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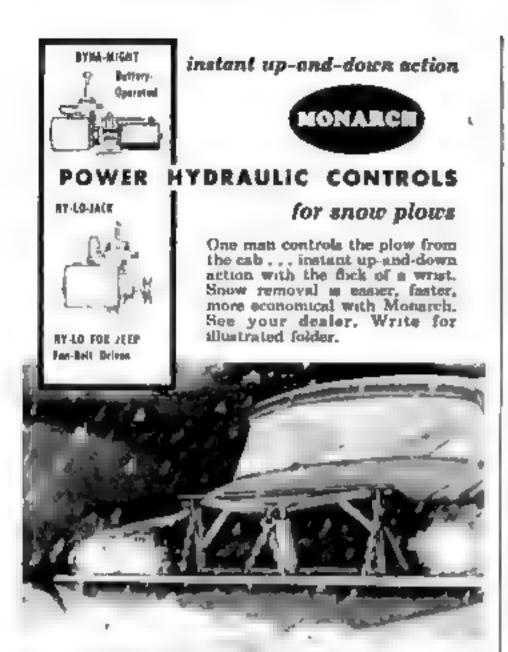


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See the pictures, get the facts, as the rest of the '61 cars are unveiled:

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speeds. That would have caused vibration, which would be worsened by the sharp angle between the segments.

Running gear. The Tempest, thanks to its rear-mounted transmission, has swing axles to let the two back wheels jounce up and down independently. There are

coil springs all around.

The F-85 and Special also have coils at all four wheels, but only the front ones are sprung independently. A conventional solid rear-axle housing ties the two rear wheels together. Two trailing arms on each side, forming a triangle with the rear axle, join the axle and differential to the body's integral frame rails.

These arms are rubber-mounted to insulate the body against noise and vibration. The outer arms, between the ends of the axle and the frame rails, transmit driving and braking forces and also control vertical stability. The shorter inner arms run from the frame to the differen-

tial and control lateral stability.

In all three cars, the front suspension comes as a complete package, fastened to a separate front cross member. The steering gear is also attached to this cross member. The whole works-cross member and its attached hardware-is held to the body side rails by six bolts. Here, too, rubber cushions keep noise and vibration from drumming through the unit bodies.



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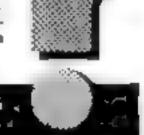
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# A Safety Expert Rates the 1961 Cars [Continued from page 93]

this type of accident. The engineering department told me that it has yet to hear of a roll-over involving a wide-track model. Indeed, they say that Fisher Body had to greatly exaggerate its standard roll-over test to make a wide-track car turn turtle. As a result, the '61 tread width is even greater, although the car is somewhat narrower in outside dimensions.

Both of these developments are significant safety factors. So, also, is a year's actual road experience with Corvair's forward-mounted gas tank. In last January's issue we speculated on the wisdom of this. The answer provided by a number of crashes is that the location under the driver's feet provides far more structural protection than is afforded the conventional tail-end tank. No crash fires involving Corvairs have been reported, while quite a few have involved conventional cars. As a result, the standard '61 Chevrolet's fuel tank has been moved forward more than two feet and given more structural safeguards. In view of the steadily mounting proportion of rearend collisions, this is good news.

Visibility. Lincoln Continental's windshield-clearing system includes two new features. First, its huge 18-inch wiper blades, operating in tandem, are driven by hydraulic power (from the return line of the power-steering mechanism). This gives much more positive pressure than either the vacuum or electric types. and enables the driver to set blade speed at any desired rate. Secondly, the windshield washer is actuated by a separate electric pump, giving the driver a water volume ranging from a dribble to a deluge. It is a real advance for foul-weather driving where the major accident factor is impaired visibility.

Good visibility, of course, is vital in good weather as well as bad. Hence, while the seeing distance from the eye to the road immediately in front of the car is improving this year in most lines, vision in the rear quarters has not increased. In fact, with the exception of the Olds F-85, visibility aft is quite limited in the compacts. This is unfortunate in view of the penchant of small-car drivers for darting in and out of small gaps in

traffic.

### A Safety Expert Rates the 1961 Cars

What happened to the periscope? This brings us back to our long advocacy of a periscopic rear-view mirror, and last year's enthusiasm when the American Optical Company developed an economically workable version. Sadly, the only 1961 model on which you'll find it is the experimental XP-700 Corvette—strictly a paper tiger.

When the AO periscopic mirror was shown to automobile manufacturers, they unanimously hailed it as a significant safety advance. However, the final consensus was typical: "This would be swell for about two years. Then we'd have to change it, and where would we be?" Thus the consuming mania for change for change's sake hamstrings a sorely needed safety feature.

One leading safety engineer told me: "When you come out here looking for new developments, you forget that one of our toughest jobs is to keep the improvements we've already made. If we can just hold our own in a face-lifting year, we've really scored a victory over the stylists."

Do people care? Over and over you hear the plaintive objection that "safety doesn't sell. The public isn't interested in it." So far the public has done little to contradict this. The sad decline of the seat belt is a case in point. Another is the fad for roof racks, After years of effort to lower the center of gravity, engineers now see their handswork crowned by roof racks upon which are piled everything but the kitchen sink.

After marked success in selling Detroit on moving control buttons, knobs, and other protrusions behind the steering wheel where they can do less harm, we now witness the sale of over four million statuettes, placed smack in the center of the dash where they can poke out a front passenger's eye in a collision. Finally, the most dangerous type of car built, the convertible, is enjoying its highest ratio of sales in history.

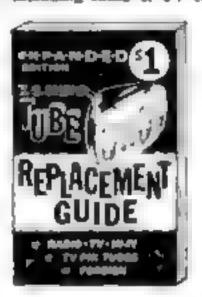
Such things would seem to confirm the industry's historic conviction that the motoring public is none too bright. Perhaps Detroit may finally be compelled to give the motoring public maximum protection by the one means neither Detroit nor the public wants: a Federal law prescribing safety standards, fixed by an unbiased agency.

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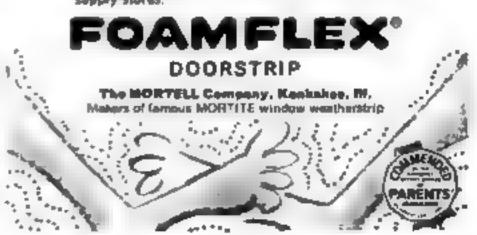


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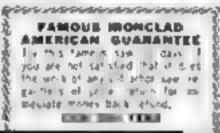
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### What's Coming in the Imports [Continued from page 95]

available by November. One interesting feature of the unit: If the transmission is accidentally shifted into reverse while the car is moving forward, reverse gear doesn't engage and the transmission loses no teeth.

The new Borgward Big Six four-door saloon should reach these shores this fall. The prestige car has a 2.3-liter, 100-hp. six, basically the same as that of the Isabella, that delivers a top speed above 100 m.p.h.

Porsche, Engines and bodies probably will remain unchanged, but improved brakes and suspensions, successful on racing models, may be adapted to the entire Porsche line within the next few months.

France Jet. This tiny roadster, introduced at the 1960 New York Auto Show. hasn't been imported yet. By the time you read this, however, a contract may have been signed with a U.S. contractor that will put the Jet on sale all over the country. Scheduled changes for 1961 include an American-made 1,081-cc. engine to replace the present 280-cc. unit, and a nine-inch body extension in front. Wheel size of the little car will jump from 10 to 13 inches.

DAF. Informed circles predict complete retooling late next year. The factory isn't letting out any specific information.

Berkeley. This diminutive sports roadster probably will have a restyled body: new grille, headlights faired into the fenders more neatly. The optional highercompression engine should become standard in the new model.

Ferrari. A four-passenger car modeled after the 250GT should go on sale late this year. Body styling is new. The GT engine is pushed forward and suspension relocated to make room for the extra passengers. Price and performance will both be as dazzling as the 250GT's.

The California model will have a shorter wheelbase and a suspension reworked for better handling.

Toyota. The Tiara, a new model that has just reached U.S. dealers, should soon be available in two-door stationwagon and pickup form. The current 75-hp. Tiara engine may be warmed up alightly.-Alex Markovich.

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### 257 POPULAR SCIENCE OCTOBER 1960

# What to Do with Your Old Atom Smashers

OLLEGE laboratories in the U. S. always running short of something they can't get along without and lacking funds to buy it—soon will have a huge scrapbox to rummage through in emergencies.

Just as the home handyman squirrels away his bits and pieces in old tobacco tins against a day when he or a neighbor is sure to need that certain bit of wire or odd-size nut, so industry is urged to toss its spare parts and useful unused equipment into the academic acrapbox.

The project is now under way for a trial run at Case Institute of Technology, Cleveland, where a warehouse has been set up. If all goes well, the what-do-youwant-maybe-we-have-it service will be extended to any academic lab that wants in.

The idea was conceived by H. M. Reese and H. E. Miller, whose business is preparing technical literature. They're masterminding the project, soliciting contributions of anything useful from nuta and bolts to vacuum tubes.

As a starter they called on industry for assorted sizes of hookup wire, relays, solenoids, limit switches, meters, rheostats, timers, valves, power-transmission equipment, fastening devices, control devices, electronic hardware, photographic equipment and materials, machine shop supplies and tools, visual aids, technical books, and bound periodicals,

Particularly desirable are three groups of material: 1) manufacturing rejectsequipment that can't be sold but is usable as is or with minor repairs; 2) product samples, used for display or demonstration work; 3) discarded equipment tagged for the junk pile while still useful,

Reese and Miller call their project "Operation Button Jar" because it resembles the collection into which the thrifty housewife dips to find a button to match the one that broke off in the washer. They plan to classify and catalogue their "buttons" as they enter the warehouse and channel them to participating laboratories as needed.

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